MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: H. H. KIMBALL.

VOL. XXX. JULY, 1902. No. 7

INTRODUCTION.

The MONTHLY WEATHER REVIEW for July, 1902, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: Regular stations of the Weather Bureau, 160; West Indian service stations, 17; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Government Survey, 75; Canadian Meteorological Service, 33; Jamaica Weather Office, 130; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rican Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Capt. François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq. Secretary, Meteorological Office, London; and Rev. Josef Algué, S. J., Director, Philippine Weather Service.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San Jose, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

North Atlantic weather was seasonable and no special storm warnings were required.

In the United States the month was characterized by low average temperatures and excessive rainfalls in the northern and by prevailing dry and warm weather in the southern districts. In the first decade of the month heavy rains caused floods in Iowa and the Mississippi River rose above its banks between southern Iowa and Illinois. In the third decade heavy rains resulted in destructive floods in Texas. The usual flood warnings were given timely distribution in the flooded districts. In the first and second decades of the month destructive rains occurred in the Genessee Valley, New York.

The unseasonable weather of July in the northern part of the United States was associated with a rapid succession of areas of low barometric pressure that crossed the northern districts east of the Rocky Mountains. These areas were attended by heavy local rains that were accompanied by sudden and marked falls in temperature. During the periods of fair weather that alternated with the cloudy areas the maximum temperatures were high, but the average of the minimum and maximum temperatures furnished a monthly mean that corresponded closely to the average temperature for July. The apparent average coolness of the month in the northern districts was therefore due to the fact that the periods of high temperature while frequent were of short duration.

CHICAGO FORECAST DISTRICT.

Storm warnings displayed on the upper lakes on the 16th were justified.

Thunderstorms and heavy showers were exceptionally frequent in the Missouri and upper Mississippi valleys and the Lake region during the first and second decades of the month.—*F. J. Walz, Inspector.*

NEW ORLEANS FORECAST DISTRICT.

No storm warnings were required during the month. The frequent and heavy showers in Texas during the last ten days of the month were accurately forecast.—*I. M. Cline, Forecast Official.*

DENVER FORECAST DISTRICT.

No special warnings were issued during the month.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

Pleasant weather prevailed on the Pacific coast during the greater part of the month. From the 22d to 25th unusually warm weather prevailed in California. On the 24th the maximum temperature exceeded 115° at many points in the interior of the State. At Mount Tamalpais a temperature of 100° occurred, exceeding by 4° the highest on record at that station.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

A storm of marked severity crossed this district during the night of the 14th, for which warnings were issued six to twelve hours in advance. The wind was the heaviest on record for this season of the year. At the new North Head Weather Bureau station at the mouth of the Columbia River the maximum velocity of wind was 72 miles an hour from the southwest. No marine casualties were reported, but wheat and barley in the interior were damaged to the extent of over $100,000.—*E. A. Beals, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	*30, p. m.	39	95	3, a. m.	32	65	1,875	2.5	750	31.2
II	8, a. m.	47	125	11, p. m.	39	75	2,500	3.5	714	29.8
III	14, a. m.	44	103	17, p. m.	27	80	2,650	3.5	757	31.5
IV	17, a. m.	54	121	23, a. m.	38	80	3,200	6.0	533	22.2
V	30, a. m.	50	107	31, p. m.	46	87	1,100	1.5	733	30.5
Sums							11,325	17.0	3,487	145.2
Mean of 5 paths							2,265		697	29.0
Mean of 17 days									666	27.8
Low areas.										
I	2, p. m.	43	91	4, a. m.	46	60	1,600	1.5	1,067	44.4
II	11, a. m.	53	122	14, a. m.	47	65	2,800	3.0	933	38.9
III	12, p. m.	51	114	17, a. m.	46	60	2,900	4.5	644	26.8
IV	14, p. m.	50	120	18, a. m.	45	64	2,875	3.5	821	34.2
	15, p. m.	54	114				2,550	2.5	1,020	42.5
V	16, p. m.	38	105	22, p. m.	41	70	2,050	6.0	342	14.2
VI	26, p. m.	51	114	28, p. m.	45	100	800	2.0	400	16.7
Sums							15,570	23.0	5,227	217.7
Mean of 7 paths							2,224		747	31.1
Mean of 23 days									677	28.2

*June.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk Forecast Division.*

RIVERS AND FLOODS.

The features of the month were the local floods in the Mississippi River and its tributaries in the States of Iowa and northwestern Missouri and the very destructive overflows of the rivers of eastern Texas. The Mississippi rise was almost entirely a Des Moines River flood, and extended only from Keokuk, Iowa, to the vicinity of Louisiana, Mo. It was due to heavy local rains in the Des Moines Valley on the 8th and 9th, supplemented by a downpour on the 13th in the lower Des Moines Valley and along the Skunk River, and again from the 17th to the 19th by general and heavy rains over Iowa. On the 10th the Des Moines River at Des Moines reached a stage of 21.0 feet, 2 feet above the danger line and within 1 foot of the traditional high stage of 1851. At Ottumwa, Iowa, the same river on the 14th reached a stage of 17.9 feet, 7.9 feet above the danger line. On the Mississippi River the maximum stages were as follows: Keokuk, Iowa, 15.5 feet on the 21st, 0.5 foot above the danger line; Hannibal, Mo., 16.6 feet, 3.6 feet above the danger line. The warnings for this flood were timely and accurate and of great benefit to the persons affected. The following report thereon was made by Mr. F. Z. Gosewisch, official in charge of the United States Weather Bureau office at Keokuk, Iowa:

On July 9 the Des Moines office reported the river stage at that place to be 11 feet, a rise of 2 feet in twenty-four hours. This information was immediately bulletined and given to the railroads, and at the same time special reports were called for. The stage of the Mississippi at Keokuk was then 7 feet, sufficiently low to allow any rise from the Des Moines to run out rapidly. On the 9th Des Moines reported a further rise of 4.7 feet to 15.7 feet, and the stage at Ottumwa, Iowa, was 7.8 feet. Bulletins were issued as before, and special warnings were given to those interested in bottom lands that a further rise of 4 or 5 feet might be expected. The canning and pickle companies placed men at work to protect their lands, levees were inspected and strengthened where weak, and all preparations made to prevent any avoidable damage.

Further forecasts of continued rises were made on the 10th and 11th, but on the 12th notice was given that the crest had been reached and that from that time the waters would recede. At this time a personal inspection of the threatened district near Keokuk showed that, owing to the precautions taken as a result of the warnings, the overflow had been confined to a very small portion of the lowlands. All danger was then assumed to be past, but subsequent events proved that this was only for a day. The heavy local rains in the lower Des Moines and Skunk watersheds started another rise in the lower Des Moines, which by the morning of the 14th reached a stage of 17.9 feet, 7.9 feet above the danger line at Ottumwa and a rise of 6.3 feet in twenty-four hours. At the same time the upper Des Moines continued to fall. The following forecast was issued: "The Mississippi will rise slowly south of Keokuk. An unexpected rise developed in the Des Moines between Des Moines and Ottumwa during Saturday night and that river will rise at Keokuk for the next twenty-four hours." By the afternoon of the 14th thousands of acres of standing crops in the Des Moines bottoms below Keokuk had been overflowed, with the river still rising.

By the 17th both the Mississippi and the Des Moines rivers were falling rapidly, but, as before, heavy rains on the succeeding day checked the fall, and another sharp rise was speedily inaugurated. The following warning was at once distributed along the Mississippi as far south as Quincy, Ill.: "Heavy rains on the Des Moines, Skunk, and Iowa. The Mississippi will rise. Probably dangerous."

Supplementary forecasts were issued on the 18th, and by the afternoon of the 19th Fox Island, a large tract of unprotected corn land, lying between Alexandria, Mo., and the mouth of the Fox River, was overflowed to the depth of 1 foot, the water on the Keokuk gage then showing 14.5 feet, with the Des Moines water level higher than that of the Mississippi. The crest of 15.5 feet at Keokuk was reached on the 21st, and after that time the recession was steady.

An accurate estimate of the damage can not be given. Many thousands of acres of fine corn were overflowed, and the total losses will doubtless aggregate several hundred thousand dollars.

At Hannibal, Mo., the river was above the danger line from the 15th to the 26th, inclusive, with a maximum stage of 16.6 feet on the 23d, 3.6 feet above the danger line. The estimated loss to crops and farm implements from La Grange, Mo., southward to Louisiana, Mo., was $125,000, or about 65 per cent of the value of a total crop on the inundated lands.

From below Louisiana to the mouth of the Illinois River the situation was not dangerous, although somewhat alarming between the 23d and 26th.

Nothing special occurred along the Missouri River as far as stages were concerned, although some high water was experienced between Kansas City and Boonville, Mo., due to the heavy rains of the first two weeks of the month over the lower Missouri Valley, the greater portion of the water coming from the Kansas River. At Kansas City on the 14th and 15th the stage of the river was 23.2 feet, 2.2 feet above the danger line. Warnings were first issued on the 8th, and daily thereafter until the waters began to subside. No damage of consequence was reported.

The Illinois River also contributed a generous share to the flood disturbance, causing great inconvenience and some considerable damage along its course, the upper portion especially. At Peoria, Ill., a stage of 21 feet was recorded on the 22d, 7 feet above the danger line.

The lower Mississippi, Ohio, Tennessee, and Cumberland rivers, owing to the unusual amount of rainfall, were at times much above the usual summer stages, but no danger lines were reached. A similar condition of affairs prevailed along the Susquehanna River.

The Texas floods were of a very destructive character, and the warnings issued in connection therewith were a sufficient evidence of the efficiency of the Texas flood service which was established but two years since. The following report on this flood was prepared by Mr. E. H. Bowie, official in charge of the United States Weather Bureau office at Galveston, Tex.:

Conditions render it extremely difficult to arrive at an approximate monetary value of the property loss sustained as a result of these floods, but from reports by crop correspondents, press notices, etc., $5,000,000 is considered a conservative estimate of the damage to the State as a whole from prolonged inundation of crops, loss of bridges, houses, railway tracks, etc., and suspension of railway traffic. That the loss was not greater is due in a large measure to the ample period available for protection of property between the time that the warnings were issued and the advent of the floods. A number of lives were lost in different parts of the State, the total number reported by the press being sixteen.

In the dissemination of the warnings issued by the Bureau much credit is due the daily press of this State, and especially the management of the Southwestern Telegraph and Telephone Company, for the thorough distribution of the warnings to all connecting points without expense to the Bureau.

That these warnings were heeded by the persons affected is evidenced by the following statement, from the flooded district by the correspondent of the Galveston News, under date of August 15, 1902:

"When the news that the overflow was imminent was received every hand was put to work removing all the women, children, stock, implements, and vehicles to places of safety. When this was done the men hitched up their teams and gathered corn and continued to gather it until the water poured into the wagon beds. When forced by the flood to abandon corn some of them turned their attention to the cotton fields. They cut down the entire cotton stalk before the encroaching water and carried it to high ground, hoping that the sun would cause the grown bolls to open and in this way something would be saved. When nothing more could be done in the way of saving a portion of their crops they turned their attention to the houses and anchored them to the ground with cable wire. Others put every hand they could procure to throwing up levees on the low places on the river front, hoping to keep the water back. In these and many other ways the Brazos bottom farmer has helped himself in the present disaster, and has done all that man could do to minimize the loss."

The morning reports of rainfall of the 25th of July gave the first intimation of the probability of a serious flood in the Brazos Valley, excessive rainfalls having been reported from the drainage area of this river as far north as Erath County. Special river observations were immediately called for, and at noon of the 25th the following warning was issued:

"Excessive rains over the drainage area of the Brazos are causing heavy rise in the upper section of that river. Present indications point to flood stages in the upper Brazos River during the next forty-eight hours, and in the middle and lower river within the next three to six days. Notify all interests likely to be affected."

This warning was telegraphed to points in the Brazos Valley, to the superintendent of the Southwestern Telegraph and Telephone Company at Austin, and given to the press for publication.

During the 25th the river at Kopperl rose steadily from a stage of 13.0 feet at the time that the warning was issued to 28.0 feet during the night of that date. It continued at or above the danger line (21 feet) during the 26th, 27th, and 28th, receding to a stage of 8.0 feet on the 29th. At Waco, on the 25th, when the warning was issued, the stage was 11.5 feet. The river at that point rose rapidly during the 25th and 26th, and during the night of the 26th a maximum stage of 34.4 feet was reached, or 10.4 feet above the danger line. On the 26th, the following message was telegraphed to the river observer at Waco for dissemination: "A maximum stage of approximately 36.0 feet will be reached at Waco during the coming night." The breaking of a number of levees south of Waco during the late afternoon and night of the 26th checked the rapid rise at that point, and the maximum stage attained fell 1.6 foot short of that forecast. The river at Waco continued above the danger line during the 26th, 27th, and 28th, and fell to below 24 feet (the danger line) on the 29th. The rise south of Waco was augmented by excessive rains during the 28th and 29th. On the 28th, in anticipation of a continuation of the heavy downpour, the following warning was issued and disseminated by telegraph, telephone, and through the daily press:

"Excessive rains again falling over the Brazos Valley have caused another rapid rise at Waco and points south thereof. Indications point to a serious overflow at all points south of Waco. Advise public to take precautions to prevent loss of property."

The heaviest damage resulted from this second rise, which was worse in the counties from McLennan southward, including Milam, Bell, Robertson, Brazos, Burleson, Grimes, Washington, Austin, and Waller counties. The crest of the flood passed Navasota on the 3d and Booth on the 8th of August. The highest stage reached at Booth was 38.0 feet. The crest of the flood passed to the Gulf on the 10th of August.

The following rainfalls for the six days, July 25 to 30, inclusive, occurred in the Brazos Valley: Brenham, 9.38 inches; College Station, 5.35 inches; Dublin, 5.58 inches; Hearne, 15.20 inches; Hewitt, 9.93 inches; Kopperl, 8.40 inches; Temple, 14.68 inches; Waco, 7.80 inches. Other rainfalls reported were less than five inches for this period.

The economic aspect of the flood to the Brazos Valley farmer is a serious one. The floods of 1899 and 1900 prevented the maturing of crops in this abnormally productive region, the dreaded boll weevil and drought in 1901 curtailed the crop more than one-half, and the flood this year leaves these people in a deplorable condition financially.

It is not improbable that efforts will now be made to levee the Brazos River. In fact first steps looking to the accomplishment of this purpose have already been taken.

Heavy rains fell in the upper drainage area of the Colorado River between the 20th and 25th of July, the heaviest falls being as follows: Abilene on the 22d and 23d, 4.44 inches; Ballinger on the 21st to 24th, 4.91 inches; Big Springs on the 22d to 24th, 9.89 inches; Colorado on the 20th to 25th, 12.28 inches. On the 26th the following information was telegraphed to the superintendent of the Southwestern Telegraph and Telephone Company at Austin for dissemination to points in the Colorado Valley:

"Rains in the upper Colorado Valley have ceased. While high water will prevail for several days in the middle and lower sections of the Colorado River, no dangerous flood stages are anticipated."

The rise in the Colorado River passed steadily Gulfward, overflowing bottom lands in a number of sections, but without causing damage to any great extent. In the vicinity of Big Springs, in the headwaters of the Colorado River, however, the damage by floods is estimated at $200,000.

The Trinity, Neches, and Sabine rivers were in flood stage during the last days of July and first decade of August, but as these rivers have their courses through sparsely settled regions, except near their sources, no accurate reports of loss are obtainable.

There was more or less damage in various parts of the State from floods in the minor rivers, a noteworthy one being that of the San Marcos River at San Marcos, Tex., as a result of 9.59 inches of rain having fallen in that vicinity during the 28th and 29th of July.

The Willamette River at Portland, Oreg., was above the danger line of 15 feet from the 5th to the 13th, inclusive, the water coming from the Columbia River. The maximum stage reached was 16.4 feet on the 8th and 9th. Due notice was given, and nothing of unusual interest occurred.

On the first day of the month the River and Flood Service of the Weather Bureau was still further enlarged by the creation of a new district, with headquarters at Sioux City, Iowa. The territory of the new district comprises the entire watershed of the Missouri River above Sioux City, and stations of observation are located on the Missouri River at Townsend and Fort Benton, Mont.; Buford and Bismarck, N. Dak.; Pierre, S. Dak.; and Sioux City, Iowa; on the Yellowstone River at Glendive, Mont.; and on the James River at Lamoure, N. Dak., and Huron, S. Dak.

The highest and lowest water, mean stage, and monthly range at 147 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions during July are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau:

Alabama.—The drought, which began about the middle of April, was effectually broken over the greater portion of the State by fairly general rains during the early and latter parts of the last decade, though at the close of the month it continued dry in many central and west central and a few northern counties. Early corn a failure; early cotton considerably damaged by drought; late corn and late cotton held up fairly well, and were improving at close of month.—*F. P. Chaffee.*

Arizona.—The season, as regards aridity and deficient supply of water for irrigation, exceeds all previous years of drought. Vegetation has languished for water and the ranges have become almost barren.—*Wm. G. Burns.*

Arkansas.—Hot, dry weather prevailed during the greater portion of the month, with light and widely scattered showers during the second decade, and ample rains from the 28th to the 31st, inclusive, except in some northern counties. Early corn was practically made by the 15th, but late corn suffered badly from lack of moisture during the third decade, and cotton began to wilt, turn yellow, and shed its forms and squares. Wheat and oat thrashing was practically completed by the 15th, the yield in some localities being better than expected, but generally below the average. Apples continued to drop, but peaches and grapes were ripening and fairly promising. Where sufficient rainfall occurred, the crop outlook at the close of the month was very promising.—*Edward B. Richards.*

California.—The yield of wheat and barley has been fully up to expectations in the central and northern portions of the State. Near the end of the month very high temperatures prevailed north of the Tehachapi. At many points in the great valley maximum temperatures exceeding 114° were reported. South of the Tehachapi the month was cooler. Pears, peaches, prunes, and plums yielded excellent crops in most sections. Fruit drying and canning have been carried on extensively.—*Alexander G. McAdie.*

Colorado.—The notable feature of the month was the general lack of rainfall. Such extreme dryness was particularly unfortunate at this time owing to the fact that practically no water was to be had for irrigation. Vegetation suffered even under ditches heretofore generally well supplied with water. Corn and potatoes withstood the drought remarkably well; the second crop of alfalfa was light, and the same was true of the grain crops except where irrigated or favored by showers. The ranges in the northeastern counties, though brown, afforded very satisfactory pasturage; elsewhere they remained short, especially in the southern counties, where it was necessary to remove live stock from localities on account of lack of grass and stock water.—*F. H. Brandenburg.*

Florida.—Crops suffered from the lack of rain until the third decade of the month. Cotton suffered from rust and the loss of foliage, and the crop will be very short. Owing to the dry weather the acreage of sweet potatoes will be less than usual. The bulk of pineapple shipments was made during the month. Shipments of vegetables and melons were much curtailed. Rain during the last decade of the month benefited citrus trees and checked the loss of fruit.—*A. J. Mitchell.*

Georgia.—The mean temperature was the highest on record for July in the past eleven years. The heat was intense throughout the first ten to twelve days of the month, day temperatures ranging from 100° to 108° in the majority of sections. The rainfall was very unevenly distributed. Drought continued in the northwestern and portions of the western and southwestern sections. Heavy rains occurred in the southeast. The general crop situation was critical in the dry districts; in other sections crops made satisfactory progress and were promising, cotton being heavily fruited and opening in many fields in the southern counties. Late peaches were practically a failure, except in a few central districts.—*J. B. Marbury.*

Idaho.—While the precipitation was unusually excessive in the extreme northern counties and excessive in the central, southwestern, and southeastern counties, there was a large area along the Snake River basin with only a trace. Fortunately the rains extended to most agricultural sections and resulted in improving the condition of all crops. Although the month was exceptionally cool and some frost occurred, no great damage to crops resulted. On the night of the 14–15th a windstorm of unusual severity visited northern counties, blowing down barns and working destruction to much timber and standing grain. During the night of the 2d and 3d snow to the depth of 3 to 5 feet fell in the Boise, Owyhee, and Cœur d'Alene Mountains.—*S. M. Blandford.*

Illinois.—The weather has generally been moderately warm during the month, though there have been periods of quite low temperature for midsummer. Showery conditions were frequent throughout the greater part of the State, and in the northern district the rain was at times very heavy. In the southern district the rains were light, and though of quite frequent occurrence were not sufficient in some localities to meet the needs of vegetation. In general the month was very favorable for the growth of crops, though there was some injury in the southern part of the State by dry weather and in the northern part by excessive rains. There has been a good yield of wheat, oats, and hay, though there was some damage to each of these by rain during harvest. In some localities the wheat yield was very large. Corn is in exceptionally fine condition generally, but there is some injury by drought in the southern part of the State. Apples promise a light crop.—*M. E. Blystone.*

Indiana.—In the south and central sections hay making and the thrashing of wheat, rye, oats, and barley were completed or well advanced, with generally satisfactory results, although in some localities grain was damaged in shock and in others the yield of wheat and hay was below average. In the north section wheat, oats, and hay were saved with difficulty, on account of frequent showers. Corn made excellent progress and the crop was in most encouraging condition at the end of the month, except in some localities of the south section where rain was not sufficient, and in parts of the northern counties where it had suffered from excessive moisture. The potato crop is promising, but it also suffered in localities of the northern section from too much rain, and in portions of the southern section on account of lack of moisture. Apples continued to fall and the indications are generally for a light crop.—*W. T. Blythe.*

Iowa.—The month was about normal as to temperature, but the precipitation exceeded all records for July in respect to average amount, frequency of showers, and distribution of moisture. The records show rainfall at one or more stations in the State every day during the month. The conditions were unfavorable for harvesting hay and grain, and for cultivation of late corn, resulting in considerable damage to crops, and total loss of acreage in low places and river bottoms. At close of the month fair progress had been made in securing the bulk of the hay and small grain, and the condition of all farm staples was rated higher than was deemed possible during the prevalence of the heavy storms.—*John R. Sage.*

Kansas.—Corn grew rapidly, eared well, and at close of month was in very good condition, except in a few northwestern counties, much of the early in the central and southern counties being hard enough to feed. Wheat and oat harvest concluded and thrashing begun. A good crop of tame hay* was secured and the cutting of a fine crop of prairie hay has begun. Apples, though falling in a few counties, promise a good crop. The potato crop is large and of fine quality.—*T. B. Jennings.*

Kentucky.—The month was fairly favorable for growing crops, although more rain would have been beneficial in many sections. Corn was generally in good condition at the close of the month. Tobacco was very uneven, the Burley districts making the best showing, while the crop was quite indifferent in many localities in the western portion of the State. The weather was generally favorable for harvesting and thrashing wheat. Other crops did fairly well during the month—*H. B. Hersey.*

Louisiana.—Dry weather during the first ten days of the month retarded the growth of crops. Cotton retained a healthy color and was materially improved by showers during the latter half of the month. While cane stopped growing in most sections, it also retained a healthy color, and, having been exceptionally well cultivated, with favorable rains a good yield is still possible. Rice suffered seriously, but late rice was much improved by showery weather toward the close of the month. Late corn made good growth. The pea crop suffered for rain early in the month, but at the close was doing well.—*I. M. Cline.*

Maryland and Delaware.—The rains have been well distributed, except for a dry period from the 11th to 17th and for a dry area from Allegany County southeastward to St. Marys and eastward to the ocean; this latter belt obtained relief, however, during the general rains at the close of the month. Corn is a very promising crop; hay has given light yields and pastures have been short at times; wheat has given a good grain, with satisfactory return for the amount of straw, but light considering the acreage; oats are a good yield generally; fall plowing has made average advance; tobacco was hurt by drought, but greatly improved by late rains; all fruit is scarce; vegetables of all kinds have been plentiful and of superior quality.—*Oliver L. Fassig.*

Michigan.—Excessive rainfall in the lower peninsula was detrimental to corn, beans, and late potatoes. At the beginning of the month the soil was thoroughly soaked and much lowland was flooded. July was wet with generally cool nights, preventing rapid growth of corn and beans, but favoring heavy growth of hay, wheat, rye, barley, and oats. Hay and grain harvests were much later than usual. Much cut hay and wheat in shock were injured, but generally the yield of the latter was large and of fair grade. Corn made slow growth during the entire month and, like other crops, was much in need of cultivation. Sugar beets made good progress and were in promising condition at close of month. On the whole the outlook for apples was promising, although scab and considerable dropping were reported.—*C. F. Schneider.*

* That is, wild hay that has been cultivated.

Minnesota.—Rains were beneficial in contral and northern central portions and in excess in the south. There were very heavy rains locally, and on the 4th and 5th and on the evening of the 15th and the morning of the 16th these were accompanied by hail and destructive winds, which laid the grains flat to the ground and tore down buildings, windmills, etc. Toward the end of the month the soil in south-central and southeastern counties became so soft from the rains that in some fields binders could hardly be used for cutting grain. Except in the relatively small areas affected by the hail and windstorms, all the small grains were in splendid condition. Rye and barley were ripening early in southern portion, and spring wheat and oats were heading. Rye, winter wheat, and barley harvest began in the south before the middle of the month, and spring wheat and oat harvest before the end of the month. Flax is generally a good crop. Corn made rapid growth. A splendid hay crop has been secured, though a great deal was spoiled by the rains. The potato crop is a large one.—*T. S. Outram.*

Mississippi.—Over the northern and western portions of the State and in some of the southern counties cotton made satisfactory growth during the month and was generally of fair size and well fruited, while in the central and extreme eastern counties the continued dry weather was very detrimental to the staple, which grew but little and was much damaged by blooming to the top and shedding, especially on hill lands, where the plants were small and unpromising. Much early corn was cut for fodder, although in a few northern counties some fields of early corn that escaped the June drought matured in good condition. Late corn generally continued promising. Cane, rice, and sorghum did fairly well. Peas were still being sown for hay and many sweet-potato slips were being set out. Pastures were poor. Peaches were only a fair crop and generally of inferior quality.—*W. S. Belden.*

Missouri.—The rainfall was very unevenly distributed, being excessive in many of the northern and western counties, while some of the southeastern counties received less than half an inch. The heavy rains in the northern and western sections retarded thrashing, oat harvest, and haying during the fore part of the month and in some districts wheat in shock sprouted considerably, and a part of the oat crop was lost, but in most sections grain that was well shocked suffered but little damage. Some hay was also damaged, but in general an excellent crop was secured in good condition. In a few of the extreme southeastern counties corn was seriously injured by drought, and in the northern sections some loss was caused by floods, but as a rule the crop made excellent progress and gave promise of being the largest in the history of the State. Cotton also suffered from drought in the extreme southeast, but elsewhere all crops, except flax, continued in excellent condition.—*A. E. Hackett.*

Nebraska.—A month of heavy rains which caused rivers and creeks in the southeast portion to overflow and seriously damage all crops in the valleys along their banks. The harvesting of wheat and oats was retarded by rain, and in the eastern section the quality of the grain was injured, while some wheat was ruined. Considerable hay and alfalfa was damaged by the rain. Corn made a vigorous growth, eared heavily, and at the end of the month promised an exceptionally heavy crop.—*G. A. Loveland.*

Nevada.—Remarkably cold weather for July prevailed over the State the first week of the month. Freezing temperatures occurred on the mornings of the 2d and 3d, and from 2 to 5 inches of snow fell on the high mountains in the north half of the State on the night of the 2d. The first and second decades were quite cool, but the last decade was unusually warm. The weather was very favorable for harvest work and the growth of irrigated crops. The water supply was quite plentiful throughout the month. A good crop of hay was cut and saved without damage. Grain ripened rapidly and some was cut and stacked. Range grass was fairly good and live stock did well.—*J. H. Smith.*

New England.—The weather was fairly favorable to crop growth, although there was a deficiency of sunshine and an excess of rain. The weather was unfavorable to harvesting and securing hay and much of the crop was secured in a damaged condition. All crops were in fairly good condition, except corn, which was much retarded by the unfavorable weather and will doubtless be a short crop.—*J. W. Smith.*

New Jersey.—The month was chiefly characterized by frequent thunderstorms, very destructive in places, being accompanied by high wind and hail. Hay and oat harvest greatly retarded; some grain still in the fields and sprouting. Growing crops at close of month were generally in good condition.—*Edward W. McGann.*

New Mexico.—Drought was quite severe in all sections excepting the southeastern portion, where the rainfall was far in excess of the normal. Irrigation water failed in many localities, and crops on temporal lands[1] were a failure.—*R. M. Hardinge.*

[1] Referring to this term "temporal lands," Mr. Hardinge adds the following note:

"Temporal lands are unirrigated lands. I can find no authority in the dictionaries for this use excepting that 'temporal' has a meaning of 'seasonal.' In this section the word is in common use as applied to such planted lands as depend on rainfall only for the raising of the crop. This use of the word is derived from the classification of lands under the old Mexican law into *irrigated, temporals*, and *pastural*. I believe we have no English word of the same significance; 'unirrigated' does not express it."

New York.—The month was unusually rainy, and disastrous floods occurred in the western plateau, and parts of central and eastern sections, either washing away crops on lowlands or causing their abandonment. Corn and beans were backward and some rot in potatoes and grapes appeared. The harvest of hay and grain was much delayed and great quantities were ruined by rains, and only a light crop of apples, peaches, pears, and hops was indicated. The acreage of buckwheat was reduced, while some improvement in the condition of crops was reported near the close of the month. July was generally very unfavorable for farm operations and for the growth of crops.—*R. G. Allen.*

North Carolina.—The month of July was characterized by a considerable excess in monthly mean temperature, very high maximum temperature, and a marked deficiency in rainfall. Conditions not favorable for the best development of crops. In fact the month was the driest July in North Carolina since 1872. During the early part of July corn continued to grow rapidly, many correspondents reporting it "best for years," but during the middle of the month upland and early planted corn suffered much from drought. Cotton and tobacco also deteriorated somewhat. Cotton generally was well bolled, and fields were kept clean and thoroughly cultivated. Cutting and curing tobacco made rapid progress during the month, and the crop cured well. Sweet potatoes and vegetables were injured by the drought. Peanuts and rice did well. Fruit was generally inferior in quality, and there was much dropping of late varieties. Grapes promised a large yield, and melons were abundant.—*C. F. von Herrmann.*

North Dakota.—The weather was generally favorable for the growth of all vegetation, and prospects for small grain were never better. Corn was backward, being retarded by cool, wet weather, but at the close of the month was growing rapidly. Some slight damage was done grain by scattered hailstorms and high winds.—*B. H. Bronson.*

Ohio.—The temperature departures were slight; precipitation excessive in northeastern counties, deficient in some southwestern. Vegetation made good growth. Corn is excellent, except in a few northern counties; a large crop of oats being secured; tobacco made good growth; second crop of clover is quite promising; apples continue dropping, though a few correspondents report a fair crop; grapes continue promising, though rotting in a number of counties.—*B. L. Waldron.*

Oklahoma and Indian Territories.—Some slight damage was caused by hot winds during the first week, but the scattered, daily showers after the 9th benefited crops in general and placed the ground in fine condition for fall wheat plowing, which was well advanced by the close of the month; wheat and oats were harvested and being thrashed; early corn was made and being cut with good yields; late corn and kaffir corn made good growths; cotton was laid by during the third week in good condition, and was squaring, blooming, and bolling by the close of the month; millet, broom corn, castor beans, and flax were being secured with good yields; hay making continued throughout the month; early fruit was being marketed and was abundant, while late fruit was greatly benefited by the showers.—*C. M. Strong.*

Oregon.—The first week was cool and wet; the remainder of the month was dry and warm, except a short cool spell at the end. Good crop of hay secured. Peach crop fair and apples good. Wheat harvest progressed finely; average crop. Italian prunes almost a failure. Good crop of vegetables.—*Edward A. Beals.*

Pennsylvania.—Like the preceding month, July was both cool and wet. Haying, harvesting, the seeding of buckwheat, and the advancement of corn were seriously retarded during the first half of the month, and there was much complaint of wheat sprouting in shock, hay being damaged, slow germination of late plantings and seedings, bottom lands being flooded, hillsides washed, and fruit "dropping." The last decade brought more favorable conditions. Oats developed rapidly and gave promise of favorable returns; the wheat crop, where thrashed, proved to be of good quality and much heavier than anticipated; corn was making satisfactory progress; tobacco plants were backward, but apparently thrifty. The early potato crop was light, and, while late plantings were making fair growth, both rot and blight were developing in many fields.—*T. F. Townsend.*

Porto Rico.—The weather conditions were generally favorable throughout the month for the growth of all crops, but the land was too dry and hard for cultivation in many localities. Sugar making was carried on and practically completed. The degree of sweetness was very low and the yield of sugar poor and unsatisfactory. Young canes have improved, but many ratoons will probably be abandoned, which will materially affect the next crop. The coffee crop rallied somewhat and the first grains were being gathered. The preparation of land for tobacco seed beds was active and the indications are that a large crop will be sown. The rice crop was in all stages from the newly sown seed to the matured grain. Some corn was harvested. Such fruits as mangoes, pineapples, and alligator pears were abundant and of good quality. The markets were generally well supplied with other fruits and vegetables during the month.—*E. C. Thompson.*

South Carolina.—The excessive heat from the 1st to the 8th when maximum temperatures of over 100° occurred in nearly all portions of the State, together with general absence of precipitation, the rapid evaporation of the little rain that fell, and low relative humidity, caused rapid deterioration of all crops, particularly of corn just approaching maturity,

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the mean temperature, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings:

Summary of temperature and precipitation by sections, July, 1902.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	82.8	+2.7	Lock No. 4	109	7	Valleyhead	53	22	2.50	−2.48	Bermuda	8.52	Letohachee	0.20
						Scottsboro		24						
Arizona	81.4	−2.4	Aztec	119	18	Duncan	33	19	0.48	−1.35	Pinal Ranch	1.83	Many stations	0.00
Arkansas	79.4	−0.7	Rison	105	16	Pond	50	21	4.49	+0.26	Texarkana	13.94	Fayetteville	0.37
						Lonoke		22						
California	72.8	−1.8	Volcano	122	13	Bodie	17	4	0.07	+0.01	Laguna Valley	2.32	Many stations	0.00
Colorado	64.8	−3.2	Blaine	109	14	Russell	19	6	1.27	−1.08	Blaine	4.25	Wallet	T.
Florida	82.3	+0.8	Molino, Wausau	105	7	Holt	56	6	5.20	−1.47	Manatee	11.66	Key West	1.57
Georgia	82.0	+2.1	Douglas	108	2	Clayton	54	28	4.55	−1.47	Stillmore	12.29	Adairsville	1.18
			Hephzibah		6									
Idaho	63.0	−3.8	Garnet	105	20	Chesterfield	26	20	1.50	−0.84	Priest River	5.61	3 stations	T.
Illinois	76.1	−0.4	Equality	104	17	5 stations	44	1	5.04	+1.53	Cambridge	11.55	Cairo	0.40
Indiana	75.7	−0.3	Mount Vernon	104	17	Winamac	41	1	3.39	+0.09	Kokomo	6.96	Cannelton	0.21
Iowa	73.1	−0.6	St. Charles	99	17	Clinton	41	1	8.67	+4.99	Odebolt	13.57	Keokuk	4.87
Kansas	76.8	−1.8	Colby, Hoxie	105	15	Colby	45	20	4.32	+0.90	Lebanon	9.80	Lakin	0.45
			Ulysses		16									
Kentucky	78.1	+0.3	Bowling Green, Cadiz	107	17	Loretto	48	22	1.91	−2.14	Catlettsburg	4.85	Hopkinsville	0.26
Louisiana	82.2	+1.0	Libertyhill	102	8	Collinston	60	21	4.56	−0.65	Plain Dealing	15.42	Prevost	0.70
			Rayne		10									
Maryland and Delaware	75.8	−0.1	3 stations	104	18, 19	Grantsville, Md	43	11	3.72	−0.67	Takoma Park, Md	7.53	Milford, Del	1.77
						Deerpark, Md		11, 24						
Michigan	69.4	+0.3	East Tawas	98	7	Wetmore	23	16	5.24	+2.48	Owosso	11.06	Detour	1.04
			Traverse City		24									
Minnesota	69.7	−1.0	Beardsley	102	29	Tower	35	9	4.76	+1.00	New Richland	11.98	Pipestone	1.34
Mississippi	82.4	+1.3	Okolona	106	4	Duckhill, University	55	22	3.68	−1.22	Aberdeen	6.76	Corinth	1.11
			Leakesville		9									
Missouri	77.0	0.0	Poplarbluff	103	15	Potosi	50	21	4.55	+0.37	Oregon	10.77	Caruthersville	0.15
Montana	62.8	−3.6	Billings	100	15, 27	Ovando	30	8, 9, 29	1.87	+0.52	Troy	5.44	Glasgow	0.03
Nebraska	72.4	−2.5	Bridgeport	111	15	Kennedy	38	17	5.93	+2.46	Ashland	13.86	Cody	0.88
Nevada	67.9	−4.5	Rioville	116	22	Palmetto	25	3	0.44	+0.32	Halleck	2.00	Several stations	0.00
New England	66.3	−2.5	Berlin Mills, N. H.	96	6	Fort Fairfield, Me	30	3	3.90	−0.77	Cream Hill, Conn	9.40	Bemis, Me	1.02
New Jersey	73.0	−1.0	Bridgeton	100	18	Charlottsburg	43	17	4.78	−0.18	Chester	9.92	Cape May, C. H	1.83
New Mexico	71.3	−1.5	Olio	110	25	Winsors	27	6	1.51	−0.65	Carlsbad	10.50	Bluewater, Olio	T.
New York	68.3	−0.6	Lyons	99	8	Axton	34	11	6.77	+3.01	Angelica	12.46	Ogdensburg	1.58
North Carolina	78.6	+0.9	Chapelhill	107	19	Linville	44	23	2.74	−2.76	Highlands	5.71	Graham	0.98
North Dakota	67.6	−0.4	Napoleon	106	24	Gallatin	34	9	2.15	−0.48	Amenia	5.20	New England City	0.08
						New England City		20						
Ohio	74.0	+0.2	Bethany	100	8	Hillhouse, North Lewisburg.	43	11	4.69	+0.78	Hillhouse	8.75	Frankfort	0.70
Oklahoma and Indian Territories.	79.7	−1.6	Healdton, Ind. T	105	9	Kenton, Okla	49	6	2.22	−1.16	Goodwater, Ind. T	8.90	Tulsa, Ind. T	0.10
Oregon	64.0	−2.4	Blalock, Umatilla	106	20	Klamath Falls	28	4	1.46	+1.01	Bay City	4.09	Umatilla	0.00
						Bend		5, 8						
Pennsylvania	71.8	+0.6	York	99	17	Dushore	41	11	6.04	+1.67	Emporium	12.35	Kennett Square	2.11
Porto Rico	79.9	0.0	Cayey	99	8	Adjuntas	53	7	4.96	−2.29	Las Marias	17.42	Santa Isabel	0.50
South Carolina	80.8	+1.0	3 stations	107	4, 6	Aiken	58	15	3.79	−1.86	Yemassee	9.62	Winnsboro	0.71
						Walhalla		21, 22						
South Dakota	71.4	−0.6	Cherry Creek	110	15	Howard	40	10	2.47	−0.29	Elk Point	8.02	Cherry Creek	0.05
						St. Lawrence		20						
Tennessee	79.0	+1.1	Springfield	106	17	Erasmus	44	22	1.97	−2.21	Tellico Plains	4.68	Kenton	T.
Texas	82.4	−1.0	Beaumont	108	14	Burnett	55	20	5.84	+3.54	Temple	19.79	Laureles Ranch	0.00
			Fort McIntosh		19									
			Cotulla		28									
Utah	68.4	−4.2	Green River	112	21	Tropic	17	3	0.32	−0.17	St. George	1.82	5 stations	0.00
Virginia	76.5	−1.0	Columbia	108	10	Buckingham	41	16	3.12	−1.44	Fredericksburg	6.34	Woodstock	0.94
						Marion		23						
Washington	63.8	−1.8	Pasco	108	20	Wilbur	30	27	1.60	+0.87	Ashford	4.11	Connell	0.00
West Virginia	74.2	−0.1	Rippon	104	17	Oceana	45	1	3.54	−0.91	Morgantown	8.42	Lewisburg	0.96
Wisconsin	70.6	+0.2	Valley Junction	96	27	Osceola	35	10	6.25	+2.85	Delevan	12.19	Antigo	0.97
Wyoming	62.7	−3.8	Basin	107	28	Daniel	26	7	0.89	−0.19	Lagrange	3.46	Hyattville	0.10

and of cotton that was then in full bloom. The former wilted and many of the ears failed to kernel, and the latter turned yellow and began to shed its leaves, squares, and young bolls. Subsequent weather conditions were more favorable, but crops recovered slowly from the set back, especially in localities where there was a large deficiency in precipitation, and these were numerous throughout the State, except in the southeastern portions where the precipitation was slightly in excess. Many points had sufficient rain during the latter half of the month and at such places all crops were in a flourishing condition.—*J. W. Bauer.*

South Dakota.—The weather was generally favorable for spring wheat, oats, barley, rye, and grass until the latter part of the month, when high temperature and much sunshine matured late spring wheat and oats somewhat too rapidly in the middle and northern counties, and insufficient moisture over large areas retarded the progress of corn, late potatoes, late flax, millet, and pastures. Corn was backward over most of the State during the entire month, but on the whole did very well until the latter part. The month closed with the rye crop and the bulk of the barley crop in shock or stack, oat harvest far advanced, spring wheat harvest begun in the extreme northern and nearing completion in the extreme southern portions, and all harvested small grains secured in shock or stack under unusually favorable weather conditions for such work and generally promising very good returns; corn mostly silking or earing. Early potatoes and flax very good, the late promising only fairly A large proportion of the hay crop well secured in stack, and range live stock in unusually good condition.—*S. W. Glenn.*

Tennessee.—The month began with corn and cotton in fine condition, and tobacco, peas, peanuts, millet, and gardens doing well; a severe drought followed, shortening the corn crop very materially and damaging all other growing crops seriously. Wheat thrashing progressed under favorable conditions, also oat harvesting and haymaking. The prospects for apples and peaches continued poor. Good rains came during the last three days of the month and greatly revived growing crops, but a large part of the early corn in the central portions of the State was too badly damaged to be much benefited.—*H. C. Bate.*

Texas.—The weather during the month was generally favorable for the growth of crops, but owing to frequent and heavy rains farm work and cotton picking were considerably retarded. The growth and development of cotton continued rapid over all portions of the State until the last decade of the month, when many fields in the valleys of the Brazos, Colorado, and Trinity rivers were flooded; many crops were either destroyed or badly damaged. Cotton was damaged to some extent by weevil and bollworms, and rust and shedding were reported from some localities after the heavy rains. At the close of the month cotton picking was general, and in central and southern sections many bales had been marketed. An

improvement was noticed in the condition of June corn, although this crop suffered along river bottom lands. Rice, sugar cane, and all minor crops made satisfactory advancement.—*Edward H. Bowie.*

Utah.—A remarkably cool spell prevailed during the first decade. Freezing temperatures and heavy frosts occurred in the elevated valleys of the State on several mornings between the 2d and 9th, badly damaging potatoes and other tender vines, and slightly damaged corn, wheat, and alfalfa in places. Irrigation water became very short before the close of the month, but on the whole growing crops did fairly well.—*L. H. Murdoch.*

Virginia.—During the first half of the month fairly favorable weather prevailed over the State and crop growth was, in the main, satisfactory, but the latter half was quite droughty and vegetation suffered considerably, especially early corn, pastures, and tobacco. Opportunities for field work were almost uninterrupted, and at the close of the month all crops were clean. Hay making, thrashing and housing of wheat, and cutting and stacking of oats were vigorously prosecuted.—*Edward A. Evans.*

Washington.—Long drought broken by heavy rains beginning on 1st, and lasting three to six days, averting danger to and causing great improvement in crops. In parts of the eastern section it was the heaviest July rainfall known. With the exception of the first week it was a splendid month for haying. Fall wheat harvest progressed during the last week; the yield was fair to good. Oats were in need of rain. The potato crop promises to be excellent.—*S. N. Salisbury.*

West Virginia.—The weather conditions during the month were generally favorable for crop growth and also for harvesting. By the end of the first week wheat was mostly in shock and some was being thrashed, with light yield. Meadows continued to thicken and improve, so that haying was not in full progress until the last week, when hay was secured in good condition, with about half a crop. Oat harvest was in progress during the last week, with a good yield, and early potatoes were made, with a good crop. Corn made excellent growth during the month, and the prospects were for a fairly good crop. Some fall plowing was being done during the latter part of the month. Apples continued to fall during the month, and the prospects were for about half a crop; peaches and plums were scarce, but grapes were quite promising.—*E. C. Vose.*

Wisconsin.—Crops generally in a very promising condition, although frequent and heavy rains damaged grains and hay in most sections and delayed the harvest. Killing frosts occurred the first of the month in the extreme northern counties and considerable damage resulted; light frost occurred in the middle section, but no damage resulted. The first of the month was exceptionally cool and retarded the advancement of corn, but later it showed a gradual and thrifty growth. Rain was materially deficient the greater portion of the month in the northeast counties. Hail did material damage in some localities, especially in St. Croix County on the 22d.—*J. W. Schaeffer.*

Wyoming.—The weather was unseasonably cool during the first half of the month and retarded crop growth some, but was warm and favorable for good crop growth during the latter half. Precipitation was sufficient in most sections of the State, except parts of Big Horn County, where some crop failures resulted. At the end of the month haying was in general progress, and the second crop of alfalfa was being secured in several sections. Gardens and grain were backward, but doing well. Ranges had become generally dry, but stock was in good condition. Prospects for winter feed were poor in sections. As a whole the month was favorable for agricultural interests.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

STUDIES ON THE STATICS AND KINEMATICS OF THE ATMOSPHERE IN THE UNITED STATES.

No. VII. A CONTRIBUTION TO COSMICAL METEOROLOGY.

By Prof. FRANK H. BIGELOW, dated August 12, 1902.

GENERAL REMARKS.

I have already published the results of certain computations and discussions on the subject of the direct connections between the variations of the solar output of energy, and the corresponding synchronisms in the meteorological elements of the earth's atmosphere. These are in particular, Solar and Terrestrial Magnetism, Weather Bureau Bulletin No. 21, 1898, and Eclipse Meteorology and Allied Problems, Weather Bureau Bulletin I, 1902, which include the substance of other minor papers related to this subject. The purpose of these studies has been, (1) to establish the fact that a synchronous connection does exist between the solar and the terrestrial forces, and (2) to derive the operation of these periodic movements so as to ultimately lead meteorology to a scientific understanding of the terrestrial seasonal climatic changes, and to a true basis for forecasts of weather conditions, at least one year in advance.

The difficulty of reaching a correct solution of this problem is well understood by those who have worked upon it, to reside in the unsteadiness of the solar output itself, and the numerous subordinate transformations of the energy, through the radiation, the general and local cyclonic circulations, till it culminates in a season having certain characteristics. The material for the study consists in the variations of the pressures, temperatures, and vapor tensions at many stations in different portions of the earth, in the fluctuations of the terrestrial magnetic field, in the changes of the spectrum energy of the solar and the aqueous vapor curves, and in the variations of the sun spots, the prominences, and the solar faculæ. The magnitude of the task involved in handling this material is such as to limit the attempt to deal with it to a few institutions having these subjects specially in charge. Among them the United States Weather Bureau has been able to make some contributions from time to time.

SUMMARY OF THE DISCUSSION OF 1898.

On pages 121–130, Bulletin No. 21, is given a brief account of an extensive discussion of the data then at hand, and the result was such as to show that there is a marked synchronism between the solar and terrestrial variations of energy. Fig. 24 serves to recall this fact and it shows that in the sun-spot period, 1878–1893, there was a true synchronism in the variation of the sun-spot areas, the European magnetic force, which is the resultant of the two components measured on a horizontal plane, and the American meteorological system. The latter includes a variation of temperature at 25 stations in the northwestern portions of the United States, the pressure at 10 stations, the variable mean movements of the storms in latitude and longitude, and the movement of the tracks of the cold waves in latitude. Each of the two latter elements was derived from an exhaustive compilation of the coordinate positions of the cyclonic centers for the interval of fifteen years ending with 1893. It led me to the following summary:

> The increase of solar magnetic intensity is synchronous with a diminution of temperature but with an increase of pressure, and this function persists throughout every phase of the research.
>
> In spite of some irregularity, there is a distinct conformity in the general sweep of these curves, and also in the tendency to describe crests during the same years. Indeed, the occurrence of four subordinate crests in the 11-year period suggests strongly that a $2\frac{3}{4}$-year period is superposed upon the long sweep of that periodic curve. Apparently this minor period is the basis of these seasonal variations of the weather conditions of the United States more than anything else, so that in long-range forecasting this period must be very carefully considered.

It was for the purpose of carrying this subject one step further forward that the discussion of the data summarized in this present paper was undertaken. There has been considerable delay in completing the work on account of many other important duties.

It is evident that the terrestrial magnetic field affords the data which is most available for studying the fundamental periods in this solar-terrestrial synchronism. An exact quantitative computation for the several elements involves a very large amount of labor, and therefore it is important as an alternative to derive the periods by *methods which shall give reliable proportional variations* of the elements. The ideal treatment is to compute the total deflecting force of the magnetic field, by using the means of 24-hourly observations of the horizontal force, the declination, and the vertical force, taking out their daily component variations in rectangular coordinates

(dx, dy, dz,) and combining them into polar coordinates s, α, β.

The next simpler method is to omit the vertical component, as one is tempted to do in consequence of the unreliable action of the Lloyd's balance, and turn the horizontal components, dx, dy, into polar coordinates σ, β, on the horizontal plane. Since it has been proved by computation that the east-west component, dy, derived from variations of the declination,

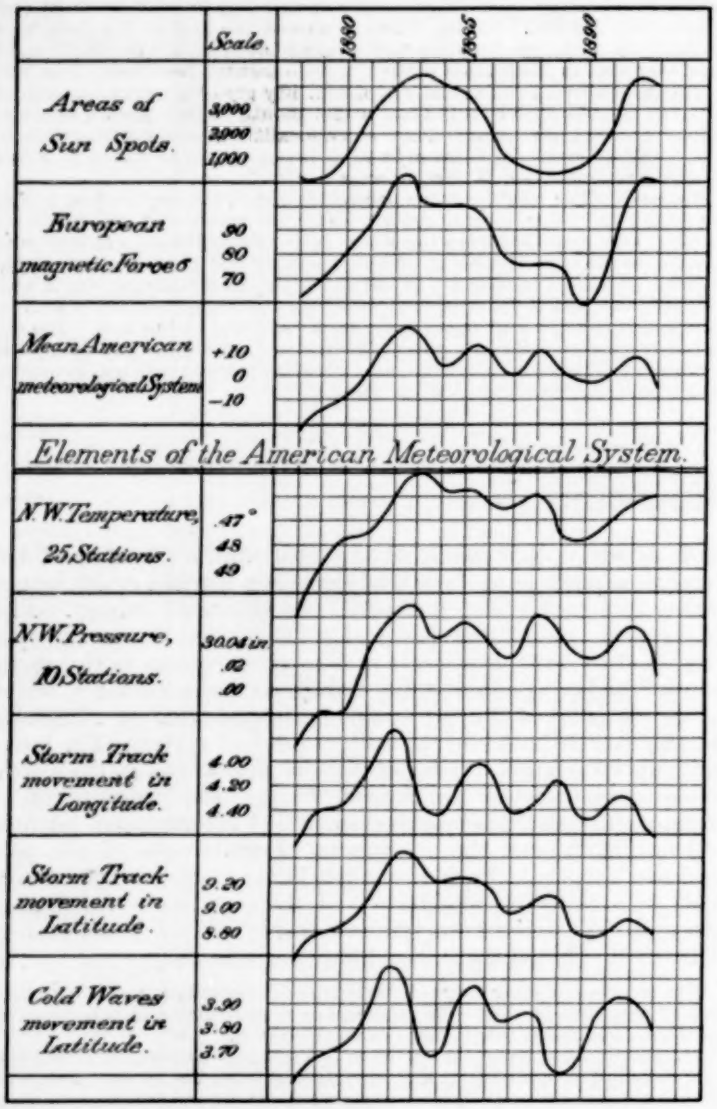


FIG. 24.

practically disappears, as it should do by theory, we may adopt the variations of the horizontal component, dx, along the magnetic meridians, as the best single component for computation. This is all the more satisfactory because the bifilar horizontal magnet is the most efficient instrument in use in the magnetic observatories, and is generally free from objectionable features in its operations. I have, therefore, in this discussion, adopted the variations of the horizontal force, as shown by the 24-hourly means, on the ground that they are proportional to the total variations of the magnetic field and quite free from instrumental errors.

THE MAGNETIC OBSERVATIONS 1841–1899.

Accordingly, the magnetic horizontal force for the interval 1841–1899 has been submitted to a discussion, the result of which is summarized in this section. The synchronous action of the solar energy, as exhibited in the variation of the sun spots, the terrestrial aurora, the magnetic field, and several other phenomena, has been frequently developed, so that the general fact is admitted by all students, but it is now important to trace out this sympathetic movement in these cosmical forces more in detail, especially as they relate to the annual and seasonal variations in the earth's atmosphere. In the Proceedings of the Royal Society, volume 63, Mr. William Ellis, F. R. S., has exhibited this synchronism between Wolf's sun-spot numbers and the declination and horizontal force at the Greenwich Observatory for the interval 1841–1896. (Compare Bulletin I, 1902, page 105.) In his diagram not only do the curves present the same large sweeps, but also the minor variations appear simultaneously in the three curves. It is for the purpose of developing yet more distinctly these minor fluctuations that the compilation of the following magnetic observations was executed.

Instead of confining the study to a single observatory, it has been extended so as to practically include the entire earth, at least sufficiently to demonstrate that the variations are common to the whole terrestrial magnetic field. Thus, for different years we studied the records at the following stations:

1841–44. Toronto, St. Helena, Hobarton.[1]

1845. Greenwich, Toronto, Singapore, St. Helena, Cape of Good Hope, Hobarton.

1846–47. Toronto, St. Helena, Hobarton.

1848. Toronto, Greenwich, Hobarton.

1849–1870. Whatever was available, as Greenwich, Toronto, Madras, Batavia, Pavlosk, some of the data being unsatisfactory.

1871–77. Greenwich, Pavlosk.

1878–1885. Greenwich, Pavlosk, Vienna, Prague, Tiflis.

1886–1887. Los Angeles, Toronto, Greenwich, Paris, Pola, Prague, Pavlosk, Tiflis, Zi-ka-wei, Batavia.

1888. Greenwich, Prague, Pavlosk.

1889–90. Greenwich, Washington, Pavlosk.

1891. Greenwich, Prague, Pavlosk.

1892–99. Paris, Pola, Pavlosk.

By thus changing the stations it becomes impossible that the peculiar action of any set of instruments, should such exist, can impose a bias upon the final result. It seems to me that it makes no difference what three stations are chosen to represent the cosmical variation of the magnetic field, as indicated by the horizontal force which is proportional to the total force. Three stations are desirable in order to eliminate the local impulses of the field, and if they had been available I should have used the same three stations throughout, all reduced to the C. G. S. system of units, for the sake of having rigorous quantitative results. The data of this paper limit it to showing relative synchronisms, but these are quite sufficient for our purposes in the present stage of meteorology.

The horizontal force, as given by the means of twenty-four successive hourly ordinates, or by a smaller number of selected hours in some cases, was considered, and the *daily variation from the normal horizontal force* was computed either numerically or graphically. (Compare the methods of Bulletins Nos. 2 and 21.) In some of the years the normal force was found by drawing a mean line through the monthly trace of the curve, as plotted from the daily means; in other years the daily variation was computed from the numerical data contained in the published reports. In all years from 1841–99 the horizontal trace was graphically transferred to curves and distributed in the period of 26.68 days, whose epoch is June 13.72, 1887; the exact adopted period was 26.67928 days, as given in the January Ephemeris. (See Bulletin No. 21, page 120.) Therefore throughout this interval the several curves, generally three in number, are plotted on the sheets, so that the irregularities as well as the agreements are open to inspection. On examining this long series of curves in succession, it is evident that a decided change occurs in the amplitudes of the variable curve with regard to the normal base line which was superposed upon each of them. In some years the curves are flat and

[1] Now called Hobart Town, or Hobart, Tasmania.

quiet, so that the ordinates are small, and the curves are free from violent or spasmodic impulses. In other years, on the contrary, the curves sway about roughly and are much disturbed, great irregularities being superposed upon them. My procedure was to measure, at least proportionally, the area which is inclosed between the variable curve and the average base line and to integrate these areas in the 26.68-day period, the 11-year period, and throughout the interval 1841–99. This was accomplished by measuring these ordinates from day to day, taking the mean of those stations selected for the given day, usually three in number, and transferring these mean ordinates with their plus and minus signs to the Ephemeris Tables. For by taking the ordinates from day to day, that is to say, at frequent intervals along the curve, their *sum is proportional to the area developed between the bounding curve and the base line.* If the actual area had been read off by means of a planimeter, the relative variation between different epochs would have been the same. These relative numbers were transferred to tables, showing the direct type curves in black ink and the inverse type curves in red ink, which can not be reproduced in this connection. These figures were now summed together by the year, the direct type and the inverse type separately, but no account is given here of this summation. Also the figures were summed across each period, without regard to their signs, so that the total divergence of amplitude might appear as a sort of integral. In each year there are thirteen or fourteen periods, but when the successive years are placed in the 11-year period, and five or six of these in the final summary, then the mean dates of the total ephemeris can be restored by simply applying 26.68 days to the mean of the January dates, that is to January 15.44, as on page 106, of Bulletin No. 21.

Table 22, "Total variations of the horizontal force for the earth generally, arranged in 26.68-day periods," contains an exhibit of these integral sums of the included areas for each 26-day period within the limits of the computation; the sums are also given for each year for five successive 11-year cycles, and for the general mean; and, finally, the differences between the annual sums for each successive year and also the average

TABLE 22.—*Total variations of the horizontal magnetic force for the earth generally, arranged in 26.68-day periods.*

11-YEAR PERIOD, 1841–1851.

26-day period.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	1851.	Means.
1	171	142	130	155	177	101	193	282	152	204	141	168
2	170	181	159	153	139	100	200	272	160	225	112	169
3	204	168	130	151	111	238	289	277	170	137	104	180
4	254	165	126	134	102	231	220	223	362	147	153	193
5	226	209	178	135	122	229	196	161	170	200	164	181
6	134	175	109	96	142	155	137	199	114	261	155	153
7	134	260	75	132	82	110	155	105	130	317	140	149
8	169	93	138	118	79	127	130	216	144	217	162	145
9	143	89	119	113	85	155	164	196	129	178	279	150
10	145	160	96	182	99	220	296	120	161	80	250	164
11	219	136	84	242	108	208	231	85	188	160	187	168
12	197	176	58	147	97	139	257	152	121	183	159	153
13	211	240	68	142	62	131	320	106	182	111	191	160
14	239	107	130	.....	126	95	.....	76	206	184	.....	160
Sums	2,516	2,301	1,600	1,900	1,631	2,239	2,788	2,470	2,389	2,604	2,197	2,293
Differences	.....	−215	−701	+300	−269	+608	+549	−318	−81	+215	−407	333

11-YEAR PERIOD, 1852–1862.

26-day period.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	Means.
1	225	118	175	86	183	105	281	162	174	281	231	183
2	248	138	134	124	134	117	186	239	224	169	182	172
3	146	138	179	126	157	125	241	150	269	208	199	176
4	258	132	170	146	142	171	262	206	273	207	194	196
5	189	168	116	107	151	188	324	225	161	131	144	173
6	153	162	100	81	128	90	190	139	168	233	171	147
7	128	139	126	90	95	125	177	225	272	202	194	161
8	133	118	91	141	111	114	163	150	305	176	208	155
9	107	163	125	112	163	192	134	271	230	212	169	171
10	154	189	127	100	165	143	194	221	168	267	253	180
11	137	122	79	131	124	213	199	379	115	187	281	179
12	152	161	104	106	92	231	205	168	148	289	166	166
13	167	148	72	93	124	282	196	330	256	259	187	192
14	129	117	.....	151	168	.....	174	151	.....	240	170	179
Sums	2,315	2,015	1,558	1,594	1,937	2,096	2,926	3,016	2,763	3,061	2,749	2,430
Differences	+118	−300	−457	+36	+343	+159	+830	+90	−253	+298	−312	291

TABLE NO. 22.—Continued.

11-YEAR PERIOD, 1863–1873.

26-day period.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	Means.
1	163	120	89	135	85	80	183	166	120	149	137	130
2	140	99	121	195	80	117	82	204	196	232	181	150
3	159	117	94	96	80	159	91	184	165	167	118	130
4	128	102	85	105	93	129	143	201	161	210	144	136
5	116	103	78	68	115	139	217	272	137	175	126	141
6	113	121	147	84	73	111	150	209	222	202	139	143
7	99	105	98	149	125	94	111	173	151	227	95	130
8	122	151	156	140	67	90	129	250	144	196	101	141
9	133	138	113	135	69	90	159	230	160	215	125	142
10	131	133	89	150	118	159	150	290	141	193	107	151
11	115	176	126	124	58	178	99	319	111	225	130	151
12	123	146	122	66	65	128	131	263	163	228	142	143
13	66	93	69	98	71	101	189	251	100	144	120	118
14	.....	95	171	98	.....	98	281	.....	186	199	.....	177
Sums	1,608	1,699	1,558	1,643	1,099	1,673	2,123	3,012	2,157	2,762	1,665	1,983
Differences	−1,141	+91	−141	+85	−544	+574	+450	+889	−855	+605	−1,097	616

11-YEAR PERIOD, 1874–1884.

26-day period.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	Means.
1	120	108	114	112	172	160	134	302	224	230	235	174
2	239	212	146	82	146	97	194	251	165	241	223	181
3	199	125	109	95	151	127	135	171	144	283	196	158
4	202	132	83	64	141	120	171	182	421	223	233	179
5	152	114	93	108	152	162	215	145	215	210	251	163
6	159	128	57	107	191	187	173	235	264	192	203	172
7	106	97	85	148	168	161	160	220	256	224	296	175
8	159	82	73	113	135	177	310	187	295	197	184	174
9	115	75	79	118	103	156	250	157	183	356	255	168
10	112	139	92	90	141	204	221	264	344	194	242	186
11	184	100	105	92	116	159	278	149	281	229	218	174
12	132	105	110	98	187	182	176	238	486	287	264	206
13	115	91	120	128	176	194	219	219	290	186	267	182
14	97	79	.....	70	180	172	.....	160	141	.....	244	157
Sums	2,091	1,587	1,266	1,425	2,165	2,257	2,636	2,880	3,809	3,052	3,311	2,449
Differences	+426	−504	−321	+159	+740	+92	+379	+244	+929	−757	+259	437

11-YEAR PERIOD, 1885–1895.

26-day period.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	Means.
1	265	136	161	177	128	101	158	261	279	143	182	181
2	223	224	162	160	153	116	174	286	200	389	156	204
3	194	276	136	222	143	126	164	298	220	205	186	197
4	197	225	172	218	147	102	182	409	207	254	191	210
5	324	198	163	223	131	94	287	278	209	210	200	211
6	183	156	130	161	130	102	139	301	223	189	156	170
7	273	174	172	140	137	115	140	330	230	147	181	185
8	141	207	178	149	138	123	157	245	302	250	232	193
9	177	263	190	157	189	115	178	211	212	295	191	198
10	247	272	208	171	184	131	302	174	229	269	170	214
11	171	242	179	184	225	164	162	255	312	128	247	206
12	201	209	149	205	251	140	191	179	191	295	256	209
13	221	127	197	139	136	117	214	231	247	176	164	179
14	257	.....	194	127	.....	110	178	150	.....	135	216	188
Sums	3,074	2,709	2,391	2,533	2,092	1,656	2,626	3,608	3,061	3,135	2,728	2,745
Differences	−237	−365	−318	+142	−441	−436	+970	+982	−547	+74	−407	447

1896–1899.

26-day period.	1896.	1897.	1898.	1899.	Means.	Average for the whole interval, 1841–1899.
1	152	165	152	172	161	166
2	220	169	179	151	180	176
3	177	169	260	249	214	176
4	254	188	178	190	203	186
5	273	203	153	157	197	178
6	194	195	190	166	186	162
7	205	203	121	134	191	165
8	185	144	128	109	142	158
9	209	100	208	103	155	164
10	229	115	169	132	161	176
11	227	124	190	145	172	175
12	248	113	148	109	155	172
13	261	178	166	102	177	168
14	.....	218	127	.....	173	172
Sums	2,834	2,285	2,369	1,920	2,467	.....
Differences	+106	−549	+84	−449	.....	.....

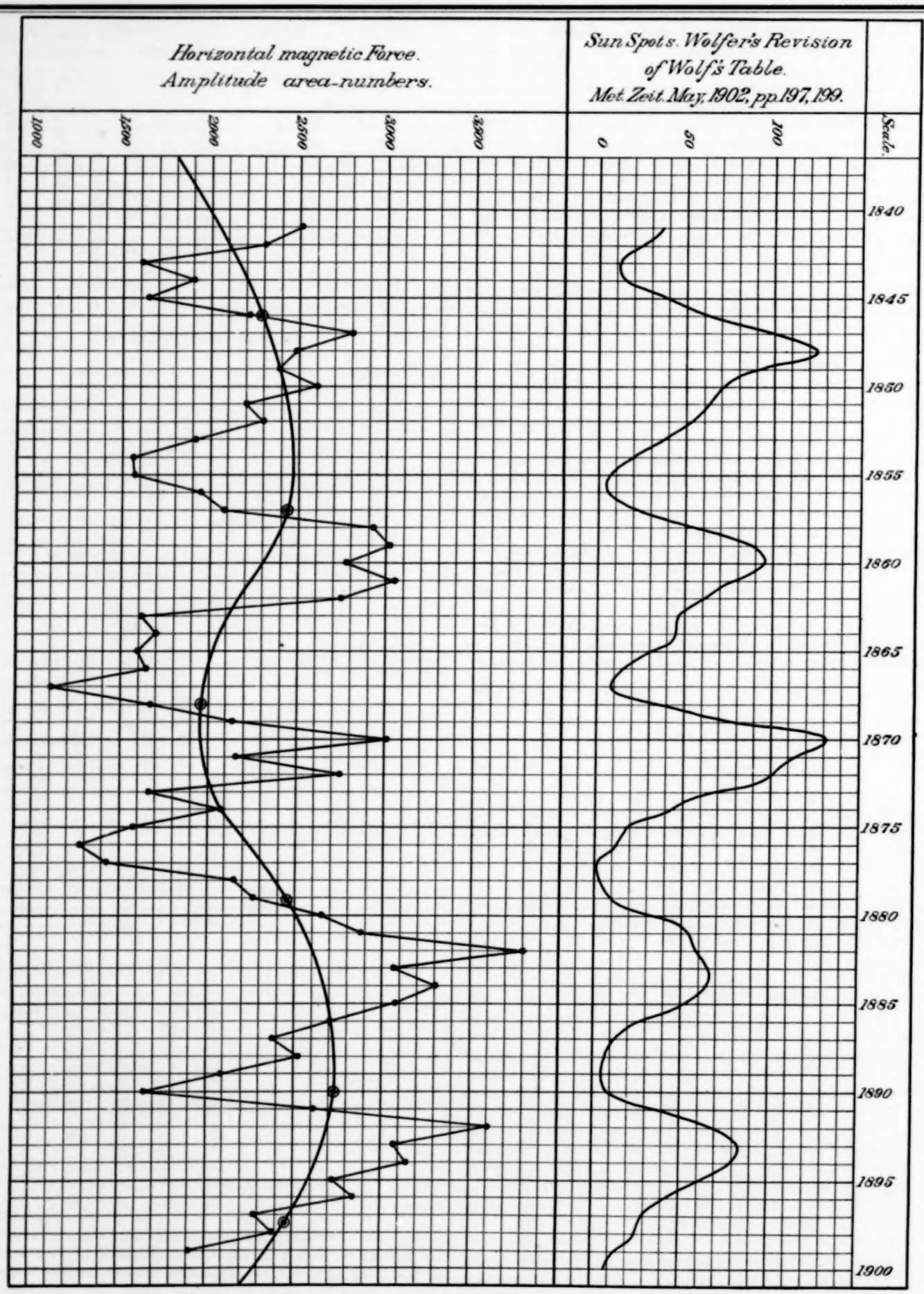


FIG. 25.—Variation of the sun-spot numbers and the amplitude area numbers.

annual variation. In taking the mean of each bottom row of periods, the mean of the numbers visible, usually 7 or 8, was increased proportionally to 11, in order to make it comparable with the other 13 periods; the action of the ephemeris causes the periodic skip in the 14th period. There was one other place in which an arbitrary change was introduced, namely, wherever the disturbance in the negative direction, at a few of the largest perturbations, exceeded —0.00040 C. G. S. units, the disturbance ordinate was computed at this value. There are only a few excessive disturbances of the horizontal force above this limit, and I did not wish to distort the average annual numbers with these great abnormalities.

The revised Wolf's table of the sun-spot numbers, by Prof. A. Wolfer, Meteorologische Zeitschrift, May 1902, page 197,[2] has been used to give the curve of the sun-spot variations, it being unimportant for this discussion whether the observed or smoothed numbers are employed.

The result of this computation, "Variation of the sun-spot numbers and the amplitude area numbers," is shown in fig. 25, the figures of Table 22 being transferred thereto. The annual sums were plotted so as to give the horizontal force curve, and the mean sums for the successive 11-year periods were plotted for the mean curve. This curve brings out three variations with extraordinary clearness: (1) The 35-year period, with maxima in 1855 and 1890, a minimum at about 1868, another probable minimum at about 1833, and one more at about 1903. After this exhibit there can be little doubt of the existence of this long period variation, discussed by Lockyer and others, and it is certain that a continuation of this method of computation will eventually fix the characteristics of this period with exactness. The fall from maximum to minimum seems to occupy thirteen years, and the rise from minimum to maximum requires a longer time, probably twenty-two years. (2) The 11-year period is seen to be in exact synchronism throughout the interval 1841–1899 with the sun spots and the horizontal force taking the curve as a whole, but there are superposed upon it a series of abrupt minor variations, which, as stated above, it is chiefly desirable to obtain for comparison with our meteorological data. (3) These subordinate crests of energy indicate that in the rise and fall of the 11-year period there is a series of spasmodic impulses, generally one in ascending the curve and two in descending, which, added to the maximum crest itself, makes four minor crests to be superposed upon the mean 11-year curve, as mentioned in the opening paragraphs, and shown in fig. 24. In the ascending branch the successive annual changes are not equal to the mean value, and this branch must evidently be considered as produced by a secondary system of crests, even though the 11-year line is not deeply indented. The discussion of this $2\frac{3}{4}$-year period will be resumed in a later section of this paper.

If the mean values of the fourteen periods as collected in the 11-year periods and indicated in Table 22 be plotted successively, the result is as shown in fig. 26. We find that there is a distinct semiannual period in the horizontal force areas, with maxima at March 22 and September 22, and minima at June 22 and December 22, thus indicating that it depends upon the orbital relations of the earth to the sun. But, furthermore, it is noted that the same 35-year period is indicated within this semiannual period, since there is a distinct minimum in the period 1874–1884, and maxima in the 1852–1862 and 1896–1900 periods, as measured by their amplitudes. Also, there is, apparently, a tendency for the spring maximum to surpass the autumn maximum, whenever they are strongest within the 35-year period. We have here indicated a field of research of importance in mechanical astronomy, since it implies that another force besides simple Newtonion gravitation is binding the sun and the earth together. It becomes an interesting problem to discover whether these magnetic forces are capable of fulfilling the outstanding theoretical requirements involved in the orbital perturbations of the earth and

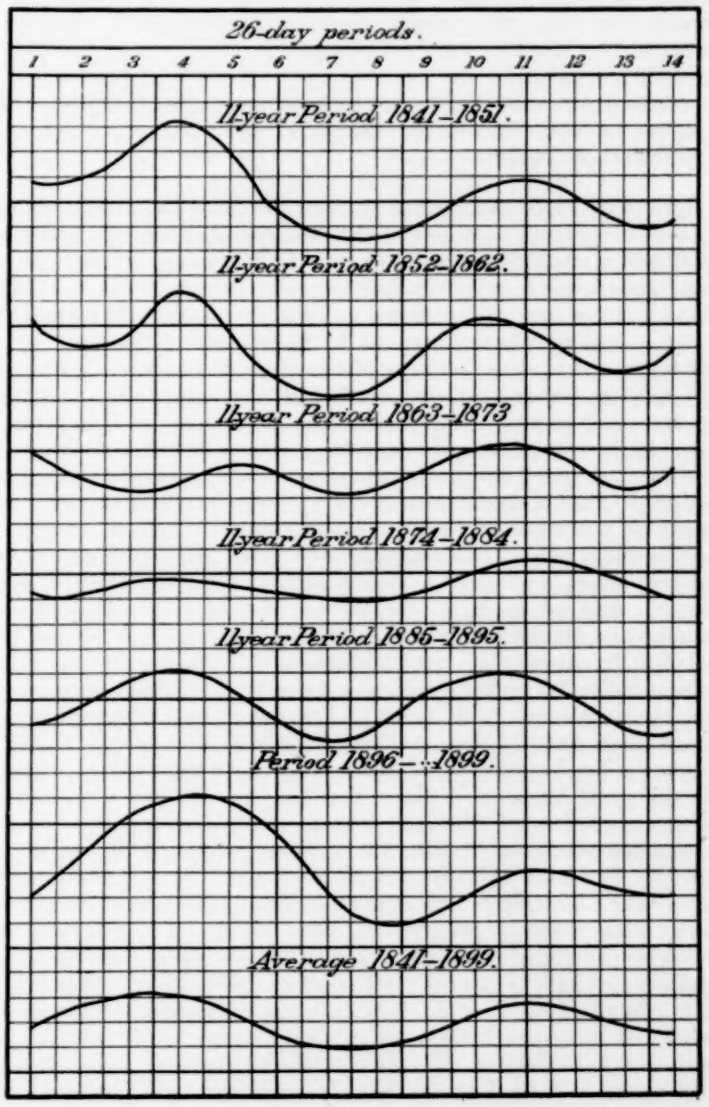


FIG. 26.—Semiannual period in the horizontal force of the terrestrial magnetic field, arranged for six successive 11-year periods.

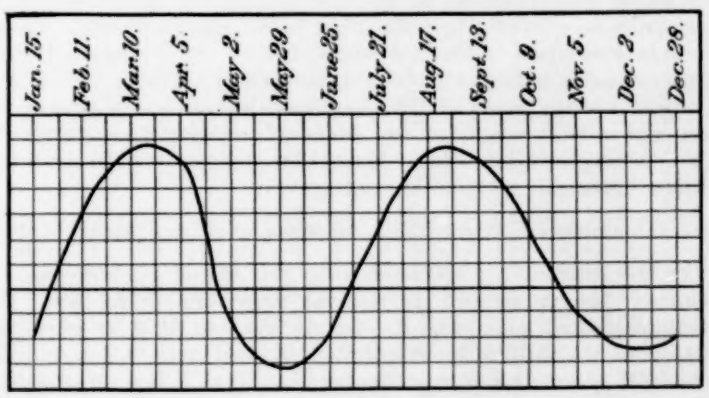


FIG. 27.

the other planets. It becomes, also, a further argument, in addition to those presented in my bulletins, Solar and Terres-

[2] This table had been originally communicated to the Monthly Weather Review and the proof sheets sent to Professor Wolfer for revision, so that as published in the Monthly Weather Review, April, 1902, page 175, the figures have the full authority of Professor Wolfer, and it is believed no typographical error exists therein.—ED.

trial Magnetism, and Eclipse Meteorology and Allied Problems, to show that the sun is a great magnetised sphere, in whose external field the earth is immersed. On fig. 27 I have copied Chart No. 19, page 106, of Bulletin No. 21, which shows the curve of the frequency of the direct type in the 26.68-day period. Its crests regularly precede those in the semiannual orbital period by a small interval, and there must be a physical reason for this divergence, such as explained in my other papers.

COMPARISON OF THE VARIATIONS OF THE SOLAR PROMINENCES WITH THOSE OF THE TERRESTRIAL HORIZONTAL MAGNETIC FORCE FOR THE INTERVAL 1874–1900.

It is well understood that the variations of the sun-spot frequency constitute only one of the manifestations of the changes in the output of the solar energy; the frequency of the hydrogen prominences, or of the faculæ, and of the extensions of the solar corona are other forms of the display of this variable force. Indeed, there is reason to believe that the sun spots are a somewhat sluggish type of the variable impulses, although the first to be studied, on account of the ease with which the spots are observed. Since scientific processes of observation have improved of late years, it has become possible to measure the frequency of the prominences and of the faculæ with precision, so that a continuous record is now being made of these types of solar energy. The prominences have been observed by Tacchini since 1873 and the faculæ by Hale and others for several years, so that it is now possible to add to the sun-spot record that of each of these two phenomena. The prominences are distributed all over the surface of the sun, and the relative frequency has been determined in 10-degree zones between latitudes $\pm 90°$ annually since 1873, so that we possess a prominence curve of relative frequency extending through more than two 11-year cycles. Through the courtesy of Sir Norman Lockyer, of the Solar Physics Observatory, South Kensington, London, I have had an opportunity to see some advance copies of different sets of curves of a very valuable character prepared by him for a paper published by the Royal Society, in which this subject is discussed, It is gratifying to note that his work confirms my curves of 1898 and is in agreement with those presented in this paper. I reproduce the Lockyer-Tacchini prominence curve, which represents the mean frequency ni all latitudes for the years 1874–1900. It is found at the head of fig. 28. It shows a large curvature synchronous with the sun-spot frequency in the 11-year cycle, and also a series of minor crests of a characteristic nature. Underneath this curve is placed the series of minor variations which were found in the horizontal magnetic force, as shown in fig. 25, after the 11-year cycle curve has been eliminated. The remarkable synchronism between these curves can not escape recognition, except after the year 1894, when an extra minor crest is developed in the horizontal force. If these two curves are compared with the 15-year systems exhibited on fig. 24, it is evident that my paper of 1898 had detected the same synchronism, not only throughout the curve of sun-spot frequency, but also throughout the whole European magnetic field and the entire American meteorological system.

THE VARIATIONS OF ATMOSPHERIC PRESSURE OVER THE ENTIRE EARTH.

In the course of my studies into this set of phenomena, including the solar and terrestrial magnetic fields and the meteorological elements, it became evident that in cosmical problems we should be compelled to deal with the variations of small quantities in meteorology, such as a few hundredths of an inch of pressure and a few degrees of temperature. It was, therefore, necessary to carefully exclude all possible sources of error due to the imperfect methods of observation and reduction, in order that variations arising from such causes might not be falsely attributed to cosmical forces. The result of such a discussion of the barometric pressures

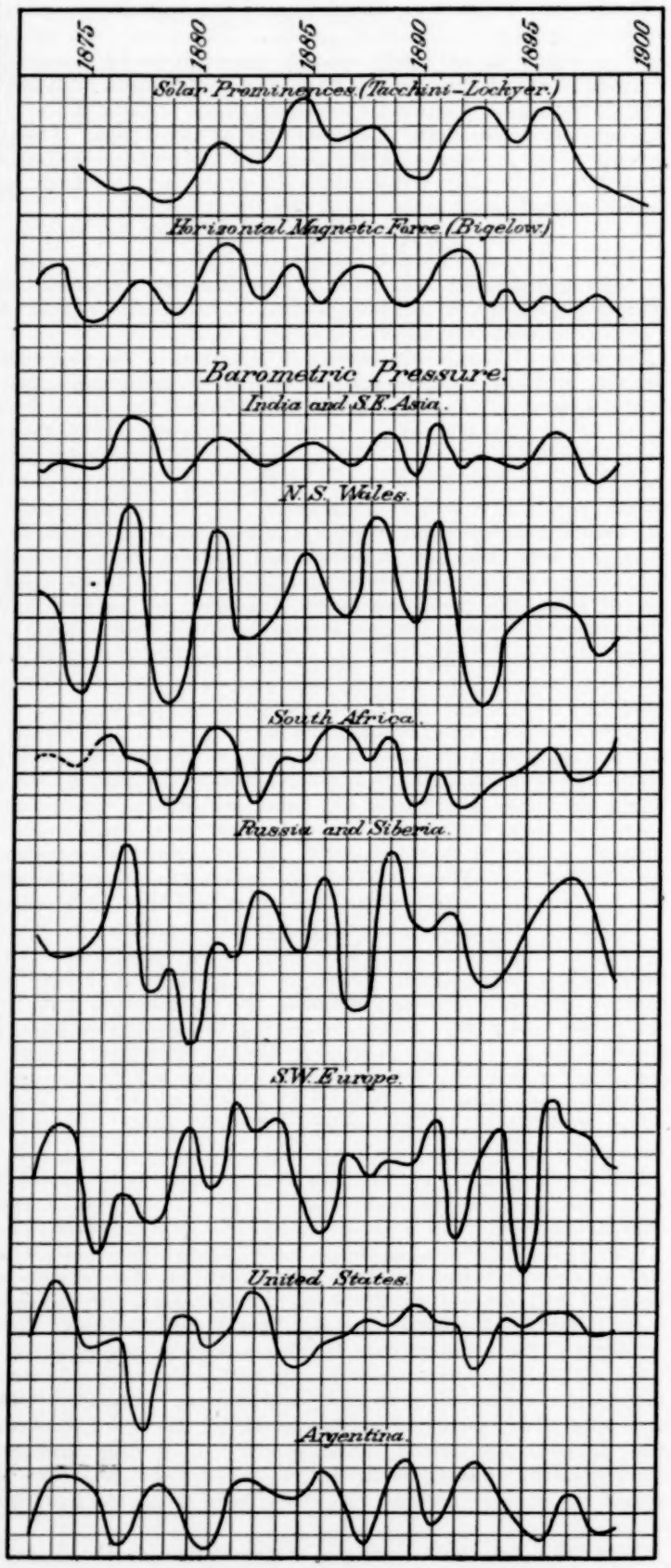


FIG. 28.—Comparison of the solar prominence variations with those of the terrestrial horizontal magnetic force and the atmospheric pressures over the entire earth.

for the United States will be found in Report of the Chief of the United States Weather Bureau for 1901, Volume II. A similar rediscussion of the temperature and the vapor tension will be executed as soon as practicable. It is important that comparable rigorously homogeneous systems should be prepared by other weather services which possess continuous long series of records of the meteorological elements. Pending the preparation of such revised systems, I have collected together a considerable number of sets or series of barometric pressures, taken in different parts of the earth, and have reduced them to a homogeneous basis, as well as I could, from a study of the published data. There are still annoying discontinuities at many stations, due to changes in the elevations of the barometers. It is also probable that the instrumental errors and the methods of reduction employed still need to be thoroughly examined.

Table 23, "The variations of the annual atmospheric pressure in many districts of the earth," serves to indicate, at least approximately, the relations of the annual barometric pressure variations to the changes in the solar output. It contains a summary of the results in the several countries where long series of barometric observations exist. It is arranged in an order which will bring out a remarkable feature of the pressure variations, as will be briefly indicated. The table gives the mean data for comparatively large districts; it is divided into groups and the mean pressures for these groups are transferred to fig. 28, which has been already mentioned. The following catalogue shows the stations that were employed in the discussion:

Northeast China.—Zi-ka-wei, Pekin, Vladivostok.
Japan.—Tokio, Nagasaki, Hieroshima, Osaka, Kioto.
North India.—Leh, Murree, Simla.
Central India.—Darjeeling, Lahore, Lucknow, Calcutta.
South India.—Pachmari, Bangalore, Nagpur, Bombay, Madras.
Batavia and Mauritius.
North New South Wales.—Albury, Bathurst, Deniliquin.
South New South Wales.—Goulburn, Newcastle, Sidney.
Kimberley.—Kimberley, Bloemfontein.
Inland Cape Colony.—Grahamtown, Lovedale, Aliwal North.
Coast Cape Colony.—Cape Town, Port Elizabeth, East London, Mossel Bay.
North Russia.—Archangel, St. Petersburg.
East Russia.—Moscow, Katharinenburg.
Russia and Southwestern Siberia.—Odessa, Tiflis, Baku.
Central Siberia.—Tomsk, Barnaul, Irkutsk.
France.—Paris.
Spain.—Madrid, Lisbon, San Fernando, Coimbra.
South Europe.—Pola, Budapest, Kalocsa, O'Gyalla, Vienna.
United States.—Pacific coast States, 20 stations; northern Plateau, 33 stations; southern Plateau, 19 stations; Lake region, 31 stations; west Gulf States, 41 stations; North Atlantic States; 26 stations; South Atlantic States, 32 stations; total number of United States stations, 202.
North Argentina.—Villa Formosa, Corrientes, Salta, Tucuman, Santiago, Goya, Hernandarias.
Central Argentina.—Cordoba, San Juan, Parana, Rosario, Carcarañia, Estancia San Juan, Buenos Ayres, Chacra de Matanzas, Bahia Blanca, Colonia Chabut.

In all cases the mean annual pressures were extracted from the observatory reports; these were reduced to the same elevation of the barometer, usually that for 1899, and all known corrections were applied. The mean for the homogeneous series was computed and then the variation of each year from this mean, the result being always changed, if necessary, into units of 0.001 inch in the English system. These annual variations were plotted as curves on sheets for the several countries, so that the several districts could be studied for their characteristic types. The stations were finally grouped as indicated in the the catalogue, and the larger district means, including about all the region having the same type of curve, were transferred to fig 28. It was very interesting to study these local curves, and to note that the same pressure variations in fact prevail over very large districts of the earth, though varying from one region to another. The variations were also transferred to charts of the earth, one for each year, and it was found that while there is an irregularity from year to year, it was possible to discover some very suggestive features. I regret that these charts can not be reproduced in this connection. Some years

TABLE NO. 23.—*The variations of the annual mean atmospheric pressures in many districts of the earth, in units of 0.001 inch.*

Stations.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
Northeast China	− 8	− 8	+ 4	−16	+12	+32	−20	−32	− 4	+24	+24	+12	+24	+20	− 4	+ 4	+24	− 8	+ 4	− 4	+ 4	+12	−12	− 4	+24	−12	−12
Japan	0	+ 8	+ 4	0	+ 4	+12	−12	+ 4	+ 8	+12	+ 8	+ 4	+ 8	+16	− 8	−12	0	−24	+ 8	− 8	+ 8	+16	− 8	+12	+16	− 8	− 8
North India	.....	.....	+ 6	− 1	+ 7	+18	− 9	− 3	+11	−13	−16	+ 1	+ 3	− 5	− 3	+ 7	+13	− 9	+20	+ 6	−14	−10	+13	+18	+ 7	− 1	+14
Central India	.....	.....	− 8	− 2	+35	+16	− 6	0	+ 3	− 9	− 4	+12	+16	+ 7	− 3	+ 8	+ 9	−11	+16	+24	+ 6	− 8	+ 3	+ 5	− 1	−16	− 3
South India	.....	.....	−10	− 8	+31	− 6	−14	0	+ 7	− 9	− 5	+11	+20	− 1	+ 2	+19	+ 8	− 3	+17	− 9	− 6	−10	+ 2	+ 5	− 7	−15	+12
Batavia	− 4	+ 4	− 8	+ 8	+43	+ 4	−20	+ 8	+16	0	−16	−24	−20	− 8	− 8	−20	+12	+ 4	+24	−12	− 4	+ 4	0	+20	+ 8	−12	+12
Mauritius	0	− 6	− 3	+ 8	+ 7	+ 3	+16	+24	+22	+16	− 7	−12	0	+ 8	+12	+12	+17	+ 2	+14	−16	+10	−22	−13	+14	0	−13	.....
Means	− 3	0	− 2	− 2	+29	+11	− 9	0	+ 9	+ 3	− 2	+ 1	+ 7	+ 5	− 2	+ 3	+12	− 7	+15	− 4	+ 1	− 3	− 1	+10	+ 7	−11	− 2
North New South Wales	+17	+ 9	−32	− 1	+55	−13	−39	−21	+46	− 3	−12	− 4	+12	+15	0	+42	+26	− 1	+54	− 6	−36	− 9	+ 7	+ 7	+ 5	−21	.....
South New South Wales	+ 7	− 2	−38	− 7	+40	−35	−37	− 4	+31	−18	− 5	+ 5	+43	+11	− 2	+44	+30	− 7	+27	−23	−47	− 3	− 3	− 2	+ 1	−13	.....
Means	+12	+ 4	−35	− 4	+50	−24	−38	−13	+39	−11	− 9	+ 1	+28	+13	− 1	+43	+28	− 4	+41	−15	−42	− 6	+ 2	+ 3	+ 3	−17	.....
Kimberly	.....	.....	.....	+ 5	− 2	+ 1	−25	+ 2	+16	+10	−14	− 4	+11	+38	+12	+34	+ 7	−23	−14	−15	− 3	− 5	+ 3	+12	− 4	− 9	+ 4
Inland Cape Colony	.....	.....	.....	+14	+ 9	+ 5	−16	− 7	+25	+17	− 5	+ 5	− 8	+11	+29	+ 4	+27	− 5	+ 3	−11	−11	+ 2	− 3	+ 3	−11	− 2	+19
Coast Cape Colony	.....	.....	.....	+30	+ 8	+ 4	− 3	+17	+18	+ 4	−26	+25	+17	+11	+14	−18	+ 2	−15	+ 5	−24	−13	− 2	+ 3	+15	+ 5	+ 2	+18
Means	.....	.....	.....	+16	+ 5	+ 3	−15	+ 4	+20	+10	−15	+ 9	+ 7	+20	+18	+ 7	+12	−14	− 2	−17	− 9	− 2	+ 1	+10	− 3	− 3	+14
North Russia	.....	−24	+55	+39	+35	−75	+20	−71	+16	+24	+43	+55	+ 4	+55	−35	− 8	+79	+47	+20	− 8	−47	−16	+24	+59	+63	+20	−43
East Russia	.....	−20	−12	+ 8	+63	−16	−12	−67	− 4	−32	+32	−12	−20	+24	−47	−55	+51	+20	0	+36	−16	− 8	−12	+36	+39	+16	−24
Southwest Siberia	.....	+28	−20	+ 8	+32	−24	−12	− 8	+ 8	+16	+20	+20	+ 4	+16	+ 8	−16	+ 8	+28	+36	−12	−16	+12	−24	+12	+ 4	+24	−20
Central Siberia	.....	0	−12	−24	+67	+40	−32	−16	− 4	−12	+ 8	0	+ 8	+28	−32	−24	+43	−39	−20	+43	+16	−20	+20	− 8	+24	− 4	+24
Means	.....	− 3	+ 3	+ 8	+49	−19	− 9	−41	+ 4	− 1	+26	+16	− 1	+31	−27	−26	+45	+14	+ 9	+15	−16	− 8	+ 2	+25	+33	+14	−16
Paris	0	+39	+24	−43	−28	−24	−12	+20	0	+ 8	+20	+35	+12	−43	+39	0	+12	+16	+24	−32	+20	+16	−43	+51	+20	+32	.....
Spain	−12	+20	+12	−28	+16	0	−12	+16	−32	+55	+32	+ 4	−32	−20	−28	− 8	+20	−16	+12	−39	− 4	+20	−47	+35	+24	0	− 8
South Europe	+12	+12	+ 4	−24	−12	−35	−28	+32	+16	+32	+12	+39	−12	−16	+20	+12	−12	+16	+35	−16	+12	+28	−43	+16	+16	+12	+16
Means	0	+24	+13	−32	− 8	−20	−17	+23	− 5	+32	+21	+26	−11	−26	+10	+ 1	+ 7	+ 5	+25	−29	+ 9	+21	−44	+34	+20	+15	+ 4
Pacific coast	+15	+ 3	+22	0	−12	−31	− 4	+19	− 1	+ 7	+16	−27	−15	− 2	+ 1	−16	−15	+16	+ 3	+ 6	+ 9	+ 8	+ 8	− 4	+ 7	− 1	+ 1
North Plateau	.....	.....	.....	−20	− 8	−28	−24	− 7	− 4	− 4	+18	− 7	− 5	0	− 6	+11	+16	+14	− 7	+ 8	−18	− 5	+10	+ 5	+12	+12	− 4
South Plateau	.....	.....	.....	+ 3	− 9	−25	− 9	− 8	−13	− 1	+11	− 5	+ 8	+ 5	− 1	+ 4	+22	+20	− 5	+ 2	−12	+14	+12	+ 8	+ 6	+ 1	− 3
Lake region	−15	+28	0	−12	+11	−51	+10	− 6	+ 2	+ 7	+15	+ 2	−20	0	+ 1	+24	+ 8	+12	+ 7	+20	−32	−12	−10	+ 6	+11	−11	+ 2
West Gulf States	− 1	+19	+ 8	+ 7	+ 2	−49	+ 7	+13	−15	+ 1	+15	− 6	−12	− 9	− 5	+ 8	+ 6	+11	+ 1	+ 4	−21	+12	+ 6	+ 9	0	− 3	0
North Atlantic States	−10	+34	+ 4	−20	+ 5	−67	+10	+21	− 8	+20	+31	− 1	−33	− 6	− 1	− 1	−11	− 1	+15	− 8	−16	+17	− 8	+10	+ 8	− 3	+11
South Atlantic States	− 1	+31	+ 9	− 2	−10	−58	+17	+25	−14	+13	+18	− 8	−31	−13	− 2	+ 4	−12	+12	+ 6	+ 6	−19	+ 9	− 7	+15	+ 2	− 1	+ 4
Means	− 2	+23	+ 9	− 6	− 3	−44	+ 1	+ 8	− 8	+ 6	+18	− 7	−15	− 4	− 2	+ 5	+ 2	+12	+ 3	+ 5	−16	+ 6	+ 2	+ 7	+ 7	− 1	+ 2
North Argentina	− 4	+12	+ 8	+ 8	−20	+ 4	+ 8	− 4	−12	+20	+16	+16	+16	+16	− 8	−20	+ 8	+20	− 8	+ 8	+24	0	− 4	.....	.....	.....	.....
Central Argentina	−16	+20	+20	+12	−12	+16	+16	−12	−20	+ 4	+ 4	0	− 4	+20	+12	− 8	+12	+28	− 4	+ 8	+24	+16	− 8	−12	+ 8	− 8	.....
Means	−10	+16	+14	+10	−16	+10	+12	− 8	−16	+12	+10	+ 8	+ 6	+18	+ 2	−14	+10	+24	− 6	+ 8	+24	+ 8	− 6	−12	+ 8	− 8	.....

show that in North America and South America the annual pressure prevails in excess, or that the variation is positive, as 1874, 1875, 1883, 1890, 1892, 1897. Others show that the entire Northern Hemisphere is in defect as a whole, as 1876, 1878, 1879, 1885, 1887, 1893. Others show the Northern Hemisphere to be in excess, as 1883, 1896, 1897. Other years are more irregular. I have the impression that there is a westward movement of the defect in pressure, or of the negative residuals; and that there are similar groups separated by intervals of seven or eight years. This subject will require an exhaustive study by meteorologists in the future, and much valuable information will be extracted from it.

If the positive values of the pressure variations be added together for each year, and also the negative values by themselves, the result may be indicated as it is plotted in the curves of fig. 29' The upper curve is for the positive and the lower for the negative summation, but these curves show, since they rise and fall together, that these values do not cancel each other. The curves match fairly well with the prominence curve, and I take it to mean that *some external force is at work to raise and lower the total atmospheric pressure by a small amount from year to year.* It is probable that a more rigorous discussion would eliminate certain distortions of this curve, and show that it synchronizes very closely with the curve of the variations of solar energy. If this proves to be so, it raises some exceedingly interesting questions in cosmical meteorology.

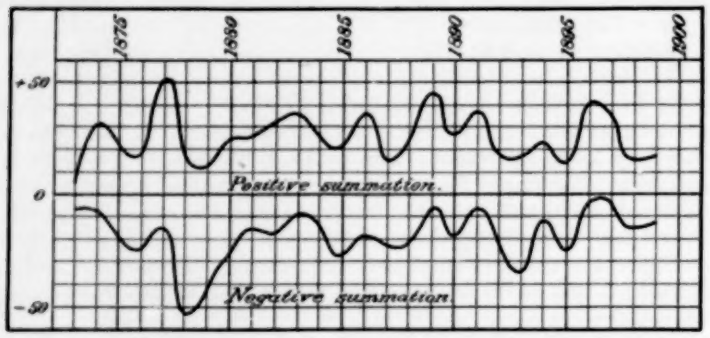


FIG. 29.—Positive and negative pressure variations over the earth as a whole for successive years, on a scale of relative numbers.

It is interesting to compare the results of this series of annual variations, 1873–1899, with those of the series, 1874–1884, studied by H. H. Hildebrandsson,[3] the latter, however, extending the details to the monthly values. The data of the Barometry Report make it possible to do this readily for the United States with little additional labor.

Returning to fig. 28, if we compare the successive pressure groups with the prominence curve, it will be seen that India and southeastern Asia are in very close synchronous agreement. This synchronism extends also to New South Wales, the Indian Ocean, and even to south Africa. In Siberia and Russia the synchronism begins to break a little and seems to be transferred somewhat toward the right, although this may be due in part to defective data. In Europe and in the United States, while the same curve is developed as to the number of the maxima and minima, the synchronism becomes more irregular. In South America, on the other hand, the synchronism is resumed very distinctly, but the *entire curve is reversed as referred to India and the Eastern Hemisphere.* Thus we perceive that around the Indian Ocean the synchronism is clearly developed; it weakens in Europe and North America, and it becomes a distinct reversal in South America. I presume that this remarkable phenomenon is due to the fact that the Pacific-Indian Ocean is quite free from frequent cyclonic disturbances, as is also South America, and that the atmospheric pressure surges back and forth between these two central or southern hemispheres, or else slowly rotates about the entire earth, probably from east to west. In North America and Europe, while the type curve reappears less perfectly, it still exists, and the disturbance may be due to the turbulent cyclonic circulation, which prevails over this region of the earth in marked contrast with the quiescent circulation of the other regions. It is, however, of much importance to have shown that changes in the annual atmospheric pressure of the earth synchronize approximately with the typical output of solar energy.

From this rapid survey of the cosmical meteorological problem, it is obvious that meteorology has large interests in solar and terrestrial magnetism. The annual reports of magnetic observatories are usually published several years after the records are made, hence, if meteorology is to insure any progress in seasonal forecasting, it evidently must possess its own magnetic apparatus, so that the state of the solar-terrestrial field may be known in connection with current meteorological phenomena. It must be conceded that considerable scientific skill will be required to bring this system of cosmical forces into control for the benefit of mankind, but I do not see how it can be doubted that the true pathway of research is already open before us. It is to be hoped that meteorologists generally will take up these cosmical problems, and compute the necessary homogeneous systems, so that it may become possible to advance promptly to practical results.

[3] Quelques recherches sur les centres d'action de l'atmosphère, par H. H. Hildebrandsson, Stockholm, 1897.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

Rainfall data for July, 1902.

Stations.	Elevation.	Amount.	Stations.	Elevation.	Amount.
HAWAII.			**MAUI—Continued.**		
HILO, e. and ne.	*Feet.*	*Inches.*	Wailuku, ne	200	0.04
Waiakea	50	12.82	**OAHU.**		
Kaumana	1,250	13.80	Punahou (W. B.), sw	47	2.87
Pepeekeo	100	11.75	Kulaokahua, sw	50	1.76
Hakalau	200	11.88	Makiki Reservoir	120	2.99
Honohina	300	9.03	U. S. Naval Station, sw	6	0.88
Puuohua	1,050	13.73	Kapiolani Park, sw	10	0.33
Laupahoehoe	500	9.72	Manoa (Woodlawn Dairy), e.	285	10.49
Ookala	400	4.48	School street (Bishop), sw	50	2.27
HAMAKUA, nc.			Insane Asylum, sw	30	2.32
Kukaiau	250	2.69	Kalihi-Uka, sw	260	8.76
Paauhau (Mill)	300	1.49	Nuuanu (W. W. Hall), sw	50	2.45
Honokaa (Muir)	425	1.22	Nuuanu (Wyllie street), sw	250	5.15
Kukuihaele	700	2.22	Nuuanu (Elec. Station), sw	405	4.05
KOHALA, n.			Nuuanu (Luakaha), e	850	12.66
Niulii	200	3.44	Waimanalo, ne	25	1.68
Kohala (Mission)	521	3.13	Maunawili, ne	300	6.13
Kohala (Sugar Co.)	235	2.42	Ahuimanu, ne	350	6.56
Hawi Mill	.....	3.70	Ewa Plantation, s	60	0.25
Puuhue Ranch	1,847	1.65	Waipahu, s	200	0.00
Waimea	2,720	1.04	Moanalua, sw	15	2.02
KONA, w.			Rhodes gardens (Manoa)	300	13.05
Holualoa	1,350	11.97	Nahuina (Castle)	1,150	10.21
Kealakekua	1,580	13.23	Tantalus Heights (Frear)	1,360	10.95
Napoopoo	25	5.16	**KAUAI.**		
KAU, se.			Lihue (Grove Farm), e	200	2.38
Kahuku Ranch	1,680	3.09	Lihue (Molokoa), e	300	2.29
Pahala	850	0.49	Lihue (Kukaua), e	1,000	6.68
PUNA, e.			Kealia, e	15	1.14
Volcano House	4,000	3.79	Kilauea, ne	325	4.85
Olaa, Mountain View	1,700	16.80	Hanalei, n	10	6.55
MAUI.			Eleele, s	200	0.25
Waiopae Ranch, s	700	0.00	Wahiawa Mountain, s	2,100	12.85
Kaupo (Mokulau), s	285	5.42	McBryde (Residence)	850	4.15
Kipahulu, s	300	8.41	Lawai	450	4.96
Nahiku, ne	1,600	22.75	East Lawai	800	3.49
Nahiku, ne	850	14.36	West Lawai	200	1.68
Haiku, n	700	2.98	*Delayed June reports.*		
Kula (Erehwon), n	4,500	5.02	Waimanalo	.....	7.45
Puuomalei, n	1,400	2.40	Kailua (Hawaii)	.....	5.78
Kula (Waiakoa), n	2,700	3.49	Nuuanu (Wyllie street), sw	.....	1.87
Paia, n	180	1.32	Wahiawa (Oahu)	.....	3.07
Haleakala Ranch, n	2,000	1.84			

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W. It is the Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.

Hawaiian standard time is $10^h\ 30^m$ slow of Greenwich time. Honolulu local mean time is $10^h\ 31^m$ slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, July, 1902.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.									Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	29.99	76	70	83	75	65.7	67	.....	.....	3	30.05	29.98	0.01
2	30.01	74	71.5	84	75	67.3	71	ne.	4	7-3	30.07	30.00	0.06
3	29.99	76	71	82	73	69.7	80	ne.	3	7	30.05	29.97	0.14
4	29.96	74	70	84	74	68.3	71	ne.	3	3	30.02	29.96	0.05
5	29.94	73	70	83	74	68.0	75	ne.	4	7-4	30.01	29.94	0.15
6	29.95	70	69	82	73	69.5	79	ne.	3-1	8-4	29.99	29.91	0.07
7	30.00	74	70	84	68	68.7	81	ne.	1-2	4-2	30.04	29.96	0.06
8	29.99	75	68.5	85	72	68.5	73	ne.	3-1	3	30.04	29.99	0.02
9	29.94	76	70.5	84	74	67.3	70	ene.	3-1	3	30.02	29.95	0.04
10	29.96	75	70	85	73	68.3	72	ne.	3-1	5	29.99	29.91	0.01
11	29.97	77	70.5	86	73	68.7	73	se-ne.	2-0	3	30.01	29.95	0.00
12	29.96	77	71	86	74	67.3	67	ene.	3	3	30.03	29.96	0.00
13	29.93	73	69	84	75	68.0	75	ne.	2-3	7-3	30.00	29.94	0.43
14	29.95	76	69.5	82	70	66.0	69	ne.	3-4	6-3	29.98	29.92	0.12
15	29.95	75	69.5	81	72	67.0	72	nne.	3-4	5	30.00	29.95	0.27
16	29.97	76	71	82	74	68.7	77	ne.	3-5	3	30.02	29.94	0.16
17	29.97	75	70	84	73	67.0	69	ne.	3	6-2	30.02	29.94	0.01
18	29.99	75	69.5	85	73	66.0	67	nne.	3	2-0	30.02	29.95	0.12
19	29.99	75	70	84	71	67.5	70	ne.	3-4	4-1	30.02	29.97	0.00
20	30.00	76	70.5	85	74	68.0	72	ne.	3-2	2-5	30.05	29.96	0.05
21	30.02	74	70	85	73	68.0	72	ne.	3-1	2-5	30.05	29.99	0.15
22	29.94	74	69	83	72	67.3	72	ne.	3	4	30.06	29.94	0.20
23	29.89	70	68	82	72	66.0	71	ne.	3-1	3	29.95	29.85	0.02
24	29.90	71	68	84	68	67.3	74	nne.	1-2	1	29.93	29.84	0.00
25	29.95	78	71.5	85	69	67.0	70	se-ne.	1-3	4	29.96	29.86	0.00
26	29.96	76	69	86	76	68.7	72	ne.	3-4	3	30.02	29.94	0.00
27	29.93	71	69	82	76	67.5	75	ne.	3-1	6	30.00	29.93	0.26
28	29.93	75	70	84	69	67.3	73	ne.	3	5	29.98	29.90	0.02
29	29.95	71	70.3	84	74	67.5	73	ne.	3	5	30.00	29.95	0.13
30	29.95	74	69.5	82	71	67.5	76	ne.	3	6	29.99	29.91	0.07
31	29.95	70	69.3	84	71	68.0	76	ne.	3-1	3	29.99	29.93	0.25
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.87
Means	29.961	74.3	69.8	83.8	72.4	67.7	73	.....	2.7	4.0	30.011	29.938	.....
Departure	—.024	.....	.....	.....	.....	+1.5	+3.5	.....	.....	0.0	.....	.....	+1.07

Mean temperature for July, 1902, $(6+2+9)\div 3=77.6$; normal is 77.1. Mean pressure for July, 1902, $(9+3)\div 2=29.973$; normal is 29.997.

*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡These values are the means of $(6+9+2+9)\div 4$. §Beaufort scale.

GENERAL SUMMARY FOR JULY, 1902.

Honolulu.—The water in artesian wells fell during the month from 33.50 to 33.40 feet above mean sea level. July 31, 1901, it stood at 33.00. The average daily mean sea level for the month was 9.86 feet, 10.00 representing the assumed annual mean. Trade wind days, 29 (3 of north-northeast); normal number for this month, 29. Average force of wind (during daylight), Beaufort scale, 2.7. Cloudiness, in tenths of sky, 4.0; normal, in tenths of sky, 4.0.

Approximate percentages of district rainfall as compared with normal: Hilo, 150 per cent; Hamakua, 50; Kohala, 82; Waimea, 30; Kona, 180; Kau, no report arrived; Puna, 120; Maui, very variable from 0 to 300, probable average, 100; Oahu, 150, varying from 100 to 200 and over; Kauai, 120.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, mean maximum, 79.4°; mean minimum, 70.6°; Waimea, Hawaii, 2,730 elevation, 77.3° and 65.1°; Volcano House, 4,000 elevation, 71.6° and 54.3°; Kohala, 521 elevation, 79.9° and 68.8°; Waiakoa, Kula, Maui, 2,700 elevation, 84.1° and 61.7°; Ewa Mill, 50 elevation, 85.4° and 70.4°; W. R. Castle, Honolulu, 50 elevation, highest 90°, lowest 69°, mean 77.9°.

Ewa Mill mean dew point, 67.9°; mean relative humidity, 71.6 per cent; Kohala, Dr. B. D. Bond, mean dew point, 68.0°; mean relative humidity, 80.0 per cent.

Heavy surf, 1st to 4th, 15th to 30th. Earthquake, Pepeekeo, Hilo, reports 15th, 12:45 p. m. Thunder and lightning, Hawaii, 16th; lightning to north of Oahu, 24th, evening. Trace of snow still visible on Mauna Kea. "Afterglow" often very marked, but not as bright as in previous month.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Science. New York. Vol. 16.

Elder, E. Waite. Iridescent Clouds. P. 196.

Rotch, A. Lawrence. The International Aeronautical Congress. Pp. 296–301.

Scientific American Supplement. New York. Vol. 54.

Dexter, E. G. The Physiological Effects of Diminished Air Pressure. P. 22291.

Pearson's Magazine. London. Vol. 14.

James, T. E. Freezing Caverns. Pp. 122–124.

Electrical World and Engineer. New York. Vol. 40.

Guarini, Emile. Wireless Telegraphy. Pp. 165–169.

Geographical Journal. London. Vol. 20.

Cornish Vaughan. On Snow-waves and Snow-drifts in Canada, with Notes on the "Snow-Mushrooms" of the Selkirk Mountains. Pp. 137–175.

Nature. London. Vol. 66.

Herschel, A. S. Heights of Sunset After-glows in June, 1902. Pp. 294–296.

Shaw, W. N. Hann's Meteorologie. [Note on Lehrbuch der Meteorologie, by Julius Hann. P. 337–338.

Stewart, Charles. Earthquake of May 28 at the Cape, and coincident Meteorological Effects. Pp. 369–370.

Baddeley, John. Colours between Clouds at Sunset. P. 370.

Hall, W. H. A Triparite Stroke of Lightning. P. 370.

Bryan, G. H. Sunset Effects. P. 390.

Pace, S. Sunset Effects. P. 390.

—— Royal Society Report on the West Indian Eruptions. Pp. 402–406.

Popular Science Monthly. New York. Vol. 51.

Ward, Robert DeC. A Year of Weather and Trade in the United States. Pp. 439–448.

Engineering News. New York. Vol. 48.

—— A study of the Southern River Floods of May and June, 1901. [Abstract of E. W. Myers' report.] Pp. 102–104.

Proceedings of the Royal Society. London. Vol. 70.

Marconi, G. A Note on the Effect of Daylight upon the Propagation of Electromagnetic Impulses over Long Distances. Pp. 344–347.

Brown, Horace T. and Escombe, F. The Influence of Varying Amounts of Carbon Dioxide in the Air on the Photosynthetic Process of Leaves and on the Mode of Growth of Plants. Pp. 397–413.

Farmer, J. Bretland and Chandler, S. E. On the Influence of an Excess of Carbon Dioxide in the Air on the Form and Internal Structure of Plants. Pp. 413–423.

Anderson, Tempest. Preliminary Report on the Recent Eruption of the Soufrière in St. Vincent, and of a Visit to Mont Pelée, in Martinique. P. 423–445.

Cave-Brown-Cave, F. E. and Pearson, Karl. On the Correlation between the Barometric Height at Stations on the Eastern Side of the Atlantic. P. 465–470.

Quarterly Journal of the Royal Meteorological Society. London. Vol. 28.

—— The State of the Ice in the Arctic Seas, 1901. Pp. 157–158.

Wilson-Barker, D. Clouds. Pp. 159–167.

—— Lightning Photographs. Pp. 167–168.

—— Sound Signals and Weather. [Note on article by E. Price Edwards.] P. 173.

—— Rainfall at San Fernando, Spain. P. 211.

——The Barograph Trace during the Typhoon, August 2–3, 1901. [Letter from Louis Froc.] Pp. 212–213.
——Cumulus Clouds formed by Smoke. [Note by Henry Mellish.] P. 214.

Journal of the Franklin Institute. Philadelphia. Vol. 154.

——Popular Errors in Meteorology. P. 192.

Proceedings of the American Philosophical Society. Philadelphia. Vol. 41.

Bryant, Henry G. Drift Casks in the Arctic Ocean. Pp. 154–161.

Scientific American. New York. Vol. 87.

——The New Whipple Temperature Indicator for use with Platinum Thermometers. P. 69.
——The Amount of Water used in Irrigation. [Note on the Report of Irrigation Investigations, by the Office of Experiment Stations, U. S. Department of Agriculture.] P. 101.
Collins, A. Frederick. Electrical Resonance and its Relation to Syntonic Wireless Telegraphy. Pp. 136–137.

Philosophical Magazine. London. 6th series. Vol. 4.

Zettwuch, Giuseppe. Researches on the Blue Colour of the Sky. Pp. 199–202.
Thomson, J. J. On some of the Consequences of the Emission of Negatively Electrified Corpuscles by Hot Bodies. Pp. 253–262.

Annales de Chimie et de Physique. Paris. Tome 26.

d'Arsonval. L'air liquide. Pp. 433–460.
Compan, Paul. Essai sur le pouvoir refroidissant de l'air et sur les lois du rayonnement. Pp. 488–574.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 135.

Henriet, H. Sur une nouvelle vapeur organique de l'air atmosphérique. Pp. 101–103.
de Moidrey. Phénomènes observés à Zi-Ka-Wei (Chine) lors de l'éruption de la Martinique. P. 322.

Annuaire de la Société Météorologique de France. Paris. 50me Année.

Maillet, Edmond. Sur la prévision des débits minima des sources de la Vanne. Pp. 109–114.
Marchand, E. Sur les altitudes des nuages inférieurs et supérieurs, et sur la constitution des nuages inférieurs dans la région des Pyrénées voisine du Pic-du-Midi. Pp. 114–119.

Ciel et Terre. Bruxelles. 22me Année.

Lancaster, A. Un intéressant phénomène; les refroidissements du milieu de juin depuis vingt ans. Pp. 231–233.
Very, F. W. Un cycle cosmique. Pp. 233–241.
Sieberg, August. Un exemple de mouvement tourbillonnaire dans les cumulus. P. 241–246.
Dobrowolski, A. Note sur les systèmes de nuages. Pp. 267–276.
L., V. D. La végétation des régions arctiques et les influences atmosphériques. Pp. 295–300.
L[ancaster], A. Le bolide du 13 juillet. Pp. 308–309.

La Nature. Paris. 30me Année.

Garcin, J. Les décharges atmosphériques. Pp. 154–155.
Garcin, J. Déformation du disque solaire. Pp. 162–163.

L'Aérophile. Paris. 10me Année.

Cousteau, —. Remarques sur la perméabilité nasale. Pp. 165–166.
Farman, Maurice. Voyage aérien du 5 juin 1902. Pp. 166–167.

Gaea. Leipzig. Vol. 38.

—— Die Zunahme der Blitzschläge. Pp. 521–535.
—— Eine Wärmere Luftströmung in 10 bis 15 kilometer Höhe. Pp. 543–548.

Himmel und Erde. Berlin. 14 Jahrg.

Foerster, August. Die dritte Tagung der Internationalen Kommission für wissenschaftliche Luftschiffahrt. Pp. 449–460.

Annalen der Hydrographie. Hamburg. 30 Jahrg.

—— Fehler in der Schätzung der Windrichtung und Windstärke auf dampfern. Pp. 371–382.
Meyer, H. Der Orkan im Indischen Ozean im Mai 1902. Verlust des dampfers "Ehrenfels." Pp. 382–390.

Annalen der Physik. Leipzig. 4 Folge. Band 9.

Grützner, P. Ueber das Mundbarometer. Pp. 238–242.

Physikalische Zeitschrift. Leipzig. 3 Jahrgang.

Caspari, W. Beobachtungen über Elektrizitätszerstreuung in verschiedenen Bergeshöhen. Pp. 521–525.

Das Wetter. Berlin. 19 Jahrgang.

Assmann, Richard. Die Erforschung der höheren Luftschichten und die Wetterprognose. Pp. 145–153.
Börnstein, R. Die Verlegung des wettertelegraphischen Dienstes auf eine frühere Stunde. Pp. 153–156.
Stentzel, Arthur. Vulkanische Dämmerungs-Erscheinungen. Pp. 156–162.

Meteorologische Zeitschrift. Wien. Band 19.

Monné, A. J. Mittlere Bewölkung zu Utrecht und Uebersicht der Gewitter im Königreich der Niederlanden. Pp. 297–302.
Draenert, F. M. Weitere Beiträge zum Klima von Recife (Pernambuco). Pp. 302–307.
Draenert, F. M. Das Klima von Parahyba do Norte. P. 307–311.
—— Die Resultate der meteorologischen Beobachtungen auf dem Mont Ventoux in den Jahren 1898–1900. Pp. 311–312.
Hann, J. Häufigkeit des Hagels zu Paris. Pp. 312–313.
Seeliger, H. Ueber das Zodiakallicht. P. 313.
Wiechert, E. Polarlicht-Beobachtungen in Göttingen. Pp. 315–316.
Kesslitz, W. Magnetische Störungen in Pola während der Eruption des Mont Pelée am 8 Mai 1902. Pp. 316–317.
—— Meteorologische Beobachtungen in Mozambique. P. 317.
—— Tod durch Blitzschlag in den Vereinigten Staaten. Pp. 317–319.
—— Ein Höhenobservatorium I. Ordnung in Japan. P. 319.
—— Temperatur und Eisverhältnisse des Nordatlantischen Oceans im Frühling u. Frühsommer 1902. P. 319.
Riegel, A. Die Gewitterperiode 1901 in Kalocsa nach den Blitzdiagrammen des Schreiber'schen Registrators. Pp. 320–322.
—— S. Figee über Regenfall zu Batavia. Pp. 322–324.
—— Forschungen auf dem Ben Nevis. P. 324–325.
—— Der Mai 1902 auf dem Sonnblickgipfel. P. 325.
—— Meteorologische Beobachtungen an der Südwestküste von Afrika. P. 325.
Gautier, R. Meteorologische Beobachtungen, angestellt an den Fortifikationen von Saint Maurice im Jahre 1900. P. 326.
—— Zum Klima von Bonneville. P. 326.
—— Witterung und Ernteertrag in Sachsen. P. 326.
—— Zur Frage über die Aussendung von Hertz'schen Strahlen durch die Sonne. Pp. 327–328.
—— Erklärung verschiedener Himmelsscheinungen durch die Hertz'schen Wellen. Pp. 328–329.
—— Die Hertz'schen Wellen bei Gewittern. Pp. 329–330.
Girschner, M. Regen-und Lufttemperaturbeobachtungen zu Messenieng auf Ponape (Ost-Karolinen). Pp. 330.
Wiebe, H. F. and Hebe, P. Ueber das Verhalten der Aneroide bei tiefen Temperaturen. P. 330–332.
—— Die Ankunftszeiten der Vögel im Frühjahre. P. 332.
Wolfer, A. Ueber die Existenz, die Vertheilung und die Bewegung der wahrscheinlichen Hauptcentra der Sonnenthätigkeit. Pp. 332–334.
—— Das Spektrum des Blitzes. Pp. 334–335.
—— Ueber einen photographischen Apparat zur genauen Analyse des Blitzes. P. 335.
—— Kugelblitzbeobachtung. P. 335.
Nijland, A. A. Ueber den grünen Strahl bei Auf-und Untergang der Sonne. Pp. 335–336.
—— Der "grüne Strahl" der untergehenden Sonne. P. 336.
Taudin-Chabot, J. J. Der "grüne Strahl." P. 337.
—— Die Theorie des "grünen Strahls." P. 337.
—— Regenperioden und Monddeklination. P. 338,
—— Meteorologische Beobachtungen in Kamerun. P. 338.
Okada, T. Ueber die Evaporationskraft des Föhn. P. 339.
—— Temperatur der Sonne. P. 342.
Wolfer, A. Provisorische Sonnenflecken-Relativzahlen für das II. Quartal 1902. P. 342.

Peterman's Mittheilungen. Gotha. Vol. 6.

Deckert, Emil. Martinique und sein Vulkanismus. Pp. 133–136.

Bollettino Mensuale, Società Meteorologica Italiana. Torino. Serie 2. Vol. 22.

Lera, Boggio. Sui miei apparecchi registratori e segnalatori dei temporali. Pp. 19–24.
Buti, Giuseppe. Sull' elettricita atmosferica. P. 5–14.

Mittheilungen aus den Deutschen Schutzgebieten. Berlin. Band 15.

—— Ergebnisse der Regenmessungen an der Station Kete-Kratyi in den Jahren 1900 und 1901. P. 31.
—— Ergebnisse der meteorologischen Beobachtungen in Kpeme. Pp. 32–33.
Von Danckelman, A. Resultate der meteorologischen Beobachtungen in Swakopmund in Jahre 1901. Pp. 90–95.

THE INTERNATIONAL AERONAUTICAL CONGRESS AT BERLIN.

By A. LAWRENCE ROTCH, Director of the Blue Hill Meteorological Observatory, dated September 4, 1902.

An International Aeronautical Congress was held at Berlin May 20 to 24, 1902, on the occasion of the third meeting of the International Committee for Scientific Aeronautics, appointed by the Paris Meteorological Conference of 1896. Of this committee there were present the president, Prof. Dr. Hergesell, of Strasburg, Prof. Dr. Assmann and Mr. Berson, of Berlin, General Rykatchef and Colonel Kowanko, of St. Petersburg, Professor Cailletet and M. Teisserenc de Bort, of Paris, and the writer, who is the American member. There were also present at the Congress, by special invitation, about one hundred military and civil aeronauts and representatives of meteorological institutions, the writer representing the United States Weather Bureau by request of its chief.

The opening of the Congress in the great hall of the Reichs-

tag building was a brilliant event. Prince Frederick Henry, of Prussia, appeared for the Emperor of Germany. Both the Imperial and the Prussian governments were represented, and the chief European nations, except France, sent the commanders or officers of their military balloon corps. After the usual formal greetings, the representative of the Prussian Minister of Education spoke as follows:

The Royal Government is much impressed with the importance and necessity of an exchange of ideas between the savants of all nations in matters concerning meteorology and terrestrial magnetism, since international cooperation in these branches of science is the indispensable forerunner of progress. This was indeed recognized as early as 1780, by the founding on German soil of the "Societas meteorologica Palatina," which undertook the task of beginning systematic weather observations in Europe, with the hope of extending them to other parts of the world. On account of the existing state of affairs its efforts were of short duration and for a short time savants were allowed to labor independently, but with the foundation of magnetic investigations by Gauss and Weber the sagacious idea of organization acquired new life and pressed for realization, especially through the development of navigation, which has the greatest interest in the accurate observation of weather phenomena on the ocean. The antarctic discoveries of James Ross, and the successful efforts of American navigators to shorten ocean voyages, gave a new impulse, and so there arose the proposition of organizing a meteorological service at the first congress of the maritime nations held at Brussels in 1854, although it was not until 1873, during the Vienna Exposition, that the first meteorological congress convened there laid the foundation of an international weather service. The international committee, appointed at that time, met at first annually, but later at intervals of two or three years. With its increasing activity the necessity of dividing the work manifested itself, and thus special commissions were formed, of which one meets here to-day and whose third gathering will probably be as fruitful as its preceding meetings. In a field where there is only interest in research may the bonds uniting the representatives of cultured nations ever become closer!

In the name of the Prussian Meteorological Institute, its director, Dr. von Bezold, spoke as follows:

The ascensions of manned balloons and kites have proved latterly an important means of exploring the atmosphere. Consequently, meteorology should rejoice in this method of observation and manifest its interest by making use of the results. There is no doubt but that the employment of such aids became more necessary, when, through the foehn phenomena, meteorologists first recognized the importance of ascending and descending currents and noticed that the formation of clouds has as close a relation to the rising currents as has the fine weather to the descending currents. Of the physical changes that are going on around us in the atmosphere, a general theoretical picture could be gained, but the deeper understanding of the phenomena required that the observer, or at least his instruments, should follow the rising and sinking air currents and so furnish more exact conclusions about temperature and humidity. Precisely for the solution of questions relating to the vertical currents, the new methods of scientific aeronautics have rendered important services and have given an insight into the mechanics of the phenomena that could not be gained in any other way. However, all preceding results are only beginnings and here, as in other branches of knowledge, it has proved to be the case that every fresh investigation raises new questions; in this case the relation of these vertical currents to whirls of air, stratification, etc. Earlier investigators had already perceived the importance of aeronautics for meteorological researches. When Charles, the inventor of the hydrogen balloon, made his several ascensions in 1783, he took with him a barometer and a thermometer, as did the American aeronaut [Jeffries] who ascended from London during the same year.* It was not until very lately that Germany took part in this work, or about the year 1880, but then with an instrument markedly superior, namely, Assmann's aspiration-psychrometer, and through the munificence of the German Emperor she was enabled to carry out the work on a large scale. For the second time the representatives of scientific aeronautics now meet on German soil and thereby recognize the importance of our efforts. But much indeed has been done for this new research by M. Teisserenc de Bort at Trappes, near Paris, through the perfection of the *ballon-sonde*, the unmanned balloon carrying self-recording instruments, and by Mr. Rotch, of Blue Hill, through his application of kites. Both methods are so good that by their use a great impetus has been given to meteorological research, whereby it is easily understood that there should be uniform rules for their employment. Looking backward it may be said that the international meetings for the organization of meteorological research, in 1854 at Brussels, in 1873 at Vienna, and in 1879 at Rome, are landmarks in the progress of the science, and that when, in September, 1896, the International Committee for Scientific Aeronautics was appointed, the plan had been so well considered and the technical necessity was so evident that there was entire unanimity in the deliberations and resolutions. The originator of the idea of the unmanned balloon was the late Gaston Tissandier, who enthusiastically explained the scheme to the speaker in 1886, although nearly ten years elapsed before its realization. This work will be fruitful, for wind and clouds have no political boundaries and the sun belongs to us all. Consequently, we are all striving, for various reasons, toward the same goal, and the motto *viribus unitis* will be, as ever, the decisive measure of the result.

Professor Cailletet, of Paris, responded for the foreigners present, and then Prof. Dr. Hergesell, after thanking the preceding speakers, spoke as follows:

As already indicated by Dr. von Bezold, the foundation, on common principles, of an international union for scientific aeronautics was, to a certain degree, long since foreshadowed. Everywhere—in Paris, Strasburg, Munich, St. Petersburg, and Berlin—aeronautical experiments for the scientific exploration of the atmosphere had taken place, and since a general wish was expressed to unite the separate efforts in a common cause, a favorable time to do this seemed to be in the autumn of 1896 at the conference in Paris of the directors of the meteorological institutes. France, the cradle of aeronautics, was the chosen ground, because there, independently of the German and Russian experiments, a most promising method of investigation had been developed that had already produced good results; for the French experimenters, Colonel Charles Renard and Messrs. Hermite and Besançon, all members of our Commission, had simultaneously put into execution the plan of exploring the highest strata of the atmosphere with free balloons carrying only self-recording instruments. Not the least service of our Commission has been to render the method of unmanned balloons comparable with the exact measurements in manned balloons as they are made in Berlin. The first task of the union was not to execute as many simultaneous manned and unmanned ascensions as possible, but rather to establish a foundation for such cooperation by prescribing accurate instruments, built according to identical principles. During our first meeting, in April, 1898, at Strasburg, the difficult problem of obtaining a uniform instrumental equipment was solved in a general way. Since then our manned balloons, here and abroad, carry the aspiration-psychrometer, which Dr. Assmann, in cooperation with the late Captain von Sigsfeld, had devised, and the unmanned balloons are provided with the normal registration apparatus which the indefatigable Teisserenc de Bort has constructed so skilfully. The registration balloon from that time has been the most powerful tool in dynamical meteorology and has furnished astounding data for the cold atmospheric strata up to a height of 20 kilometers, which are confirmed to a height exceeding 10 kilometers by the ascensions of the brave Berlin aeronauts, Berson and Süring, who have ascended so far in these regions. Since November, 1900, on the first Thursday of every month simultaneous ascensions have occurred in Paris, Strasburg, Munich, Berlin, Vienna, St. Petersburg, and Moscow, and on May 5, 1902, the 213th registration balloon of the International Commission was sent up. What a tremendous task, but how important the results! Until very recently it was assumed from Glaisher's observations that at no great height there prevailed, year in and year out, all around the globe, a nearly constant temperature. This view has been proved wholly erroneous. The assumed meteorological inaction at great heights does not exist, for the changes as regards temperature are as great at 10,000 meters as at 4,000. At the former height there are differences of temperature between St. Petersburg and Paris of 3° to 40° centigrade. Further, the observations have proved that the temperature does not steadily decrease upward, but that strata exist which often possess great differences of temperature. This stratification is one of the most important objects of the present investigation. And the future? Systematic meteorological research is at present carried on over only a small portion of the globe. Even in Europe, in the north there is lacking Scandinavia, and in the south Italy and Spain; but the presence of representatives of these countries at our meeting gives the hope of speedy cooperation. A plan for a meteorological cruise of a steamer to fly kites will also be discussed, for the meteorological exploration of the Tropics must be extended, and the participation of England in our endeavors gives us hope that India may be claimed as a region for investigation. *Per aspera ad astra*—that may be setting our goal too high, but, *per aspera ad altas et ignotas regiones*, up to the regions which hide the great secret where the weather comes from—that we certainly should fix as our goal!

The scientific sessions were now begun. At the first meeting of the Committee the following fifteen persons, nominated as members of the Committee, were elected by the Congress: Director Palazzo of the Central Meteorological Office and Major Borgatti from Italy; Director Arcimis of the Meteorological Institute and Major Vivez y Vich from Spain; Secretary Shaw of the London Meteorological Office, the Presidents of the British Meteorological and Aeronautical Societies, and Major Trollope, from Great Britain; General Neureuther, President of the Aeronautical Society of Munich; Inspector Kusnetzof

* See R. De C. Ward, in the Am. Met. Journal, Vol. IX, p. 58.—ED.

of the Russian Meteorological Service; Captain Weber, of Bavaria, Major Klussman and Captain Gross of Berlin, Director von Konkoly and Dr. von Tolnay of the Hungarian Meteorological Office. Among the first questions to be discussed was the landing of manned balloons in foreign countries. After a long debate, the following resolution was adopted: "The Commission expresses the wish that through diplomatic channels negotiations should be undertaken authorizing the necessary scientific apparatus to be carried in its ascensions. When landing in a foreign country, if difficulties arise over the photographic plates they are to be delivered for examination or development to a competent official to be named by the Commission." As regards the question of obtaining means to publish regularly the observations made during the simultaneous ascents, it was resolved that a regular official publication is indispensable.

At the second meeting Dr. Assmann presented a new volume containing the results of the work, for the two years ending last autumn, at the Aeronautical Observatory near Berlin, maintained by the Prussian Meteorological Institute.

General Rykatchef, Director of the Central Physical Observatory at St. Petersburg, spoke on the preliminary results attained with kites, *ballons-sondes*, and manned balloons during the past five years in Russia. Scientific aeronautics in Russia date only from 1899, with the exception of some years of preparatory work. Still there have been a large number of ascensions; 13 of the 60 kite-flights were above 3,000 meters, while the *ballons-sondes* reached 14,200 meters. The inclement climate of Russia occasions many unusual difficulties, for instance, the kite wire on the reel becomes thickly coated with frost, rendering the unwinding difficult, or both wire and kites in the air are so thickly incrusted with frost work (five millimeters or more) that the kites often fall to the ground. Kites were used chiefly at the stations in Pavlosk and St. Petersburg, and thereby special details were obtained in the lower strata of the diurnal and annual influence on the vertical decrease of temperature up to 3,000 meters. It was found that in summer and during the daytime the decrease of temperature with increasing height proceeds more rapidly, and, on the contrary, that in winter and during the night hours there are large inversions of temperature. In anticyclones large inversions occur in the lower strata and a rapid decrease of temperature in the higher strata. Often, in the space of a few minutes there were observed great fluctuations of temperature caused by different currents, and the study of temperature inversions showed that these take place at greater and greater heights as the time of day is later. General Rykatchef exhibited an anemometer, constructed by his assistant, Mr. Kusnetzof, for the registration of wind pressure during kite flights. The instrument has bridled Robinson cups which act like a dynamometer, and record the gusts of wind on a revolving drum. In closing, the speaker announced that the Czar had given a considerable sum of money for the continuation of this investigation of the different strata of the atmosphere in Russia by means of balloons and kites.

M. Teisserenc de Bort, of Paris, presented the results of his observations on the decrease of temperature in the high atmosphere, as obtained from the ascensions of 258 *ballons-sondes*, which had reached or exceed 11,000 meters, the total number of ascensions being 540, all of which were made at night to avoid the effect of insolation. The concordant and remarkable result is that in the layer between 8,000 and 9,000 meters the decrease of temperature becomes slower, ceasing entirely at 11,000 meters, while above that height a warming may set in, with fluctuations of 1° to 3° centigrade, making the temperature here on the average nearly constant. In the summer this isothermal layer appears to lie somewhat higher, or between 13,000 and 14,000 meters. It is lower during the prevalence of a depression, but 4,000 meters higher during a high pressure, so that the zone exceeds the height of the cirrus clouds. The lowest temperatures, occurring in a high pressure, were —67° and —72°, but in March the exceptionally low temperature of —75° centigrade was observed. Whether the absolute minimum of temperature has been reached here requires further proof and as to the cause of this striking phenomenon there are only conjectures. Have we at these great heights aerial conditions working on a grand scale, where the cyclonic whirls of the lower atmosphere do not penetrate and the currents flow uninterruptedly, and must we assume, with Maxwell, that there are stages in molecular movement where gravity and its attendant phenomena no longer act?

Prof. Dr. Assmann said that in a memoir on this subject which he had presented to the Berlin Academy of Sciences he showed that the observations of the Berlin Aeronautical Observatory, although obtained by a somewhat different method, led to the same conclusion as that which had been reached at Trappes. Above 10,000 meters the temperature oscillates and does not appear to decrease, although beyond the variable stratum, at 17,000 meters, and recently as high as 19,500 meters, the temperature was again found to decrease, so that the possibility of an absolute minimum of temperature is by no means excluded. The Berlin observations were executed with specially constructed balloons of Para rubber, which entirely avoided in the daytime the influence of solar radiation on the instrument, which was also inclosed in double polished tubes. During the six high ascensions, of which the observations have been reduced, the results stated by Teisserenc de Bort were confirmed and rises of temperature amounting to 9°, with the decreases of temperature already mentioned at still greater heights, were found. During the high ascension of Berson and Süring on July 31, 1901, the temperature of —40° was read at the identical height where the thermograph of a registration balloon, sent up at the same time, recorded —38.4°. Berson thinks it probable that the increased warmth of the anticyclone ceases between 6,000 and 8,000 meters and at greater heights the air in the anticyclone becomes colder than that in the cyclone.

Professor Palazzo, director of the Central Meteorological Office at Rome, announced that Italy would now participate in the international scientific exploration of the atmosphere. Through the aid of the Minister of Agriculture three stations for kites are proposed; one on Mount Cimone (2,165 meters), another on Etna (2,942 meters), and a third outside of Rome, near the Fort of Monte Mario. The Minister of War has ordered that the ascensions by officers of the balloon corps shall take place on the days of the international ascents. Information was given about the observatory for the study of the physics of the atmosphere, now in construction on Monte Rosa at a height of 4,560 meters, which is expected to be completed next summer. The observer is to be a scientific expert who, in addition to making the usual observations, will undertake scientific researches, remaining all summer at the observatory and going up as often as possible in winter. The observatory will also be open to other scientific men. In connection with this communication there was a discussion concerning the interest of scientific aeronautics in physiological investigations which will form an important part of the work of the high-work observatory mentioned. Professor Zuntz, who had passed eight days on Monte Rosa, stated that notwithstanding the much diminished quantity of oxygen in the air there is a great increase in the amount of oxygen used by the human organism, an effect that had not been observed when the atmospheric pressure was artificially reduced at low levels, and the cause of which is of vital interest to the aeronaut. Dr. von Schrötter, of Vienna, pointed out that the study of the chemical intensity of the light in the spectrum at great heights was one of the tasks for a high-level observatory which interested also the aeronaut. The photographic plate furnishes

the best means for the study of chemical climate, but a distinction must be made between upper and lower light, the latter being reflected from the clouds and probably acting chemically in a different way from the first, permitting, however, conclusions to be drawn as to the absorbing power of cloud strata. It appeared from the remarks made on this communication, that already in Berlin and Munich researches are in progress with photographic plates to record the action of the ultra-violet rays.

Prof. Dr. Assmann, Director of the Aeronautical Observatory of the Prussian Meteorological Institute, described his registration balloon of caoutchouc or Para rubber, which was one of the novelties of the meeting: The ordinary *ballon-sonde*, made of silk or paper and open at the bottom, has the great disadvantage that, when it approaches equilibrium in the upper strata of the atmosphere, its velocity of ascent decreases and the effect of insolation on the thermograph becomes greater, without it being possible to determine afterwards the place where the solar disturbance began during the ascent or where it disappeared during the descent; in fact, it is only in certain cases that we can distinguish between the insolation influence and the curious thermal anomalies that have been described by Teisserenc de Bort and Hergesell. The use of a closed balloon made of elastic material has this advantage, that in proportion as the inclosed gas expands, the ascensional force is increased so that the balloon rises faster with augmenting height until it bursts and then falls to the ground with diminishing velocity, because checked by a parachute. The time of equilibrium is therefore reduced to an instant, and although the higher the altitude the more intense is the solar radiation and its effect on the thermograph, yet the speed of ascent and descent is also increased and, consequently, the ventilation, which counteracts the radiation, is likewise stronger. The least possible weight of balloon envelope and of registering apparatus is required, for the lighter the whole apparatus, the less gas is needed, and the smaller the quantity of gas the more it can expand before the envelope bursts at a proportionally greater height. The meteorograph of Dr. Assmann has no clock movement, the time being unimportant; but a disk is turned by the metallic thermometer while the barometer draws a pen horizontally across the disk, and so the spiral curve indicates heights and corresponding temperatures. The apparatus exhibited weighed but 380 grams, and with the protecting basket, 500 grams. Since ink would freeze at great elevations the trace is made by a pen containing a solution of saltpeter, which writes on the disc coated with lampblack, treated with a solution of "tonsol." The chemical reaction gives a red trace that can not be obliterated by handling nor by immersion in water. The time required for an ascent to 15,000 meters is about one hour and for the descent two hours, so that the balloons do not travel very far and are usually recovered within three days. The diameter of the envelope at the start is 1 or 2 meters only, and it does not require to be completely filled with hydrogen to exert the necessary initial lift of 2 or 3 kilograms. A balloon with a diameter of 1 meter, when expanded to 2 meters has its volume increased eight times and consequently should rise until the atmospheric pressure is one-eighth, or to a height of about 15,000 meters. A balloon formed by dipping a mold into a solution of Para rubber, was expanded to sixty-four times its original volume before it burst, which indicated that it would have risen to about 38,000 meters.

Dr. Valentin, of Vienna, spoke on the sluggishness of thermographs in registration balloons, which he had investigated by exposing the Richard thermographs alternately to the action of cold and warm currents of varying velocity and comparing the time necessary to acquire the temperatures shown by sensitive mercurial thermometers. Prof. Dr. Hergesell believed that it was better to employ the most sensitive and accurate thermometers rather than to try to determine the corrections for sluggishness. He exhibited such an instrument, as did Teisserenc de Bort. The French instrument has the Bourdon tube insulated by a block of hard rubber, which prevents the injurious conduction of heat. Comparisons between an instrument insulated in this way and one not insulated gave differences which increased with the height of the balloon and at 12,000 to 14,000 meters reached 6°, an amount that justified the insulation. Prof. Dr. Hergesell spoke on the same subject in connection with a model of his new barothermograph for *ballons-sondes*. A metal strip is sensitive to changes of temperature in proportion as its weight is less and its surface is greater, consequently in his thermograph a very thin German silver tube is inclosed in a larger tube. To transmit the changes in length of the inner tube to the recording pen nickel-steel is employed, because this alloy has a very small coefficient of expansion. He has compared this apparatus with a thermograph of Teisserenc de Bort, carried by the same paper balloon and ventilated in the same way, and has found that during the ascent the first always gave lower values than the last, that is to say, it was more sensitive, and only at the maximum height, where the apparatus remained for some time at the same level, did the records approach each other. This apparatus seems also applicable at central stations where very sensitive thermometers are employed to record brief changes of temperature. It was recommended that comparative tests of the instruments of Assmann, Hergesell, and Teisserenc de Bort should be made when attached to the same balloon and that comparative readings of the two last instruments should be executed at night, to avoid errors due to insolation, at the stations of Berlin, Strasburg, and Paris. In connection with this subject, Captain von Parseval mentioned a thermometer with which his late colleague, Captain von Sigsfeld, had experimented, that was based on an entirely different principle, namely, the alteration in the specific weight of air with change of temperature. Major Vivez y Vich exhibited a "statoscope," invented by Captain Royas, designed to show the aeronaut whether his balloon was rising or falling, and Mr. Patrick Alexander, of Bath, England, described an apparatus to control the motor of a flying machine from the earth by using Hertzian waves.

At the third meeting the subject of kites and kite stations was opened with a paper by the writer on the exploration of the atmosphere over the ocean. The use of the kite on land is limited to favorable circumstances, since the wind must have a velocity of at least 5 or 6 meters per second to raise the kites and can not exceed a certain maximum strength without endangering the wire by an excessive pull. At sea, however, the motion of a steamer at a velocity of 10 or 12 knots, will almost always produce a suitable kite wind, if it does not already exist. In order to demonstrate this, in August, 1901, the writer crossed the North Atlantic on a steamer and found five out of eight days suitable for flying kites. Only on one day was the relative wind too light and on two days too strong, but the wind would always have been favorable had it been possible to alter the course of the vessel. These successful results led the writer to propose a meteorological kite expedition to the trade wind and equatorial regions of the Atlantic Ocean, where almost nothing is known of the upper currents. To defray part of the expense application has been made to the Carnegie Institution for a grant of $10,000, but it was considered that the recommendation of the present Congress might aid in securing favorable action. Applause showed the approval of the meeting, which was voiced by Drs. von Bezold and Hergesell. The former, especially, pointed out the importance and the pressing need of meteorological observations over the ocean, where, in consequence of other

methods of warming and cooling the air, very different conditions must exist than prevail over the land, and our ignorance of them is no longer to be tolerated. Professor Köppen, of Hamburg, expressed himself in a similar manner and made the interesting announcement that according to the programme of the Scandinavian Hydrographic Congress to explore the Baltic and North seas in the interest of the fisheries, four cruises a year were proposed on which meteorologists would be given an opportunity to study the atmosphere above these seas. Therefore the Deutsche Seewarte will cooperate and the speaker expected to fly kites on the first voyage of the present summer. Professor Wagner, of the University of Göttingen, said that the Göttingen Society of Sciences had, at the request of the Aeronautical Committee, furnished the geophysical expedition which was sent to Samoa about a year ago under the leadership of Dr. Tetens with kites and instruments in order to obtain meteorological observations above that island and on the return voyage over the Pacific Ocean. Dr. Hergesell mentioned that on the Lake of Constance meteorological kite flights were to be undertaken, Count von Zeppelin furnishing the vessel and the meteorological service of Alsace-Lorraine the apparatus. General Rykatchef promised on the part of the Russian Government that similar observations would be executed over the northern portion of the Baltic as well as over the Black Sea. On motion of Dr. Hergesell the plan of Mr. Rotch for a meteorological kite-expedition in the South Atlantic was fully approved, and the hope was expressed that with the aid of government funds the project might be realized in the near future. Mr. Berson remarked that it was of the greatest importance that the British as well as the Dutch governments should encourage meteorological observations in the monsoon region, and Major Trollope, speaking for Great Britain, said that he would endeavor to have this done. Professor Köppen mentioned his work with kites at Hamburg and presented a publication in the Archiv der Deutschen Seewarte describing it. He also stated that through Scandinavian and French cooperation, effected by M. Teisserenc de Bort, kite flights would be made at Viborg, in Jutland, during the next year, simultaneously with those at Hamburg and Berlin, so that interesting sections of the barometric depressions traversing north Germany would probably be obtained. Dr. Hergesell, for lack of time withdrew his paper on mountain kite stations, and only mentioned that kite flights had been made from the Grosse Belchen (1,423 meters) in the Vosges Mountains. These numerous communications show the wide extension of meteorological kite flying in Europe over land and sea.

M. Teisserenc de Bort showed a diagram of the results obtained from continuous soundings of the atmosphere, or those made as frequently as possible at his observatory at Trappes during thirty-six days in January and February, 1901, when kites and registration balloons (*ballons-sondes*) were sent almost daily into the higher atmosphere to an extreme height of 12,000 meters. The plotted results throw doubt on the assumption that the barometric depressions bring higher temperatures and the barometric maxima lower temperatures and give an interesting demonstration of the diversity and complexity of the atmospheric phenomena of which it is the aim of international aeronautics to ascertain the laws. The speaker urged the necessity of these frequent soundings, and Dr. Hergesell replied that, although this ideal exploration of the atmosphere was not so easily attained, still the simultaneous ascensions might serve a similar purpose.

The fourth meeting was principally occupied with the subject of high ascents. Professor Cailletet, of Paris, showed his apparatus for breathing oxygen at great altitudes. The chief disadvantage of the methods hitherto employed in ballooning consists in the fact that the gas is carried in a compressed state, whereby, since at each breath several liters of gas are used, strong and heavy receptacles are required. If, on the contrary, liquified oxygen is taken, which has almost the same density as water, proportionately small vessels are needed, and these can be given any convenient form. M. Cailletet employs the ordinary pear-shaped glass flask, having double walls separated by an air space and silvered externally, in order that the liquid oxygen in it shall be protected from the conduction of external heat and from solar radiation, and thereby kept in a liquid condition. By working a rubber bulb the liquid gas is driven through a narrow tube, connected with the interior of the flask, into a system of tubes having a larger amount of surface. Here it evaporates and in a gaseous state passes through flexible tubes into a caoutchouc reservoir that hangs from the ring of the balloon and is protected by a net against bursting. Thence the gas, after it has been mixed with atmospheric air, passes to the breathing mask. The mask is fastened by elastic bands in front of the face, so that the aeronaut is always forced to breathe oxygenized air. At the lower part of this mask there is an outlet tube for the expired gases, which is ingeniously arranged so that during inspiration the lower end is automatically closed, and, in order that the expired vapor may not be frozen after condensation and so stop up the tube, its lower end is placed under the clothing.

In the discussion Dr. von Schrötter reminded his hearers that it was Paul Bert who had first called attention to the fact that the want of oxygen was the cause of the pathological symptoms which man showed in rarified air. In regard to the opinion held by some Alpinists as to the inefficiency of oxygen, Professor Zuntz remarked that the exhaustion of the heart, which was not counteracted by breathing oxygen, gives rise to the same symptoms as does the lack of oxygen.

Dr. Süring spoke on the ascension which he had made with Mr. Berson on July 31, 1901, to the height of 10,800 meters, the greatest height yet reached by man. He insisted upon the importance of such high ascents to control the observations otherwise obtained and to make those that require direct vision. Especially are the strata from 5,000 to 10,000 meters not yet adequately explored, and for weather changes they are of great importance, as is indicated by the scarcity of clouds near 4,000 meters and above 6,000 meters. However, the greatest caution is necessary in these dangerous high ascensions, and all precautions should be carefully followed. The speaker explained the causes of sickness in the upper air, based on his own experience. Dr. von Schrötter also spoke on the physiology of high ascents. His experiments to a height of 7,500 meters in a balloon, and under a pressure of 230 millimeters of mercury in a pneumatic cabinet, confirmed the classic ones of Paul Bert as regards breathing oxygen, but there is still another kind of sickness at great heights, consisting in the formation of larger nitrogenous globules in the blood than can be taken care of in a normal way when the atmospheric pressure is diminished, and the pressure of these globules disturbs the nervous centers and occasions symptoms of paralysis. Great rarifaction of the air, when of short duration, has no marked influence on the number of red corpuscles. From a physiological standpoint there is still much to be investigated, notably as to endurance of cold, dampness, and light at high altitudes. Dr. von Schrötter exhibited a breathing mask of his own, which was to be tried the same day, together with the mask of M. Cailletet, during a balloon ascension.

After Dr. Süring's paper, a telegram was sent to James Glaisher in London from the scientific aeronauts of Europe, America, and Asia, in congress assembled, expressing their admiration and remembrance of this distinguished Nestor of meteorologists.* After the day's programme had been completed, Count von Zeppelin called the attention of aeronauts to

* Mr. Glaisher was born in Scotland in 1809.—ED.

a means of showing the existence of vertical currents of air by observing birds of prey hovering over mountains, for where a bird soars there must be a rising current, and hence ascents of *ballons-sondes* in such localities might prove of interest. Lieutenant von Lucanus, in the name of the German Ornithological Society, asked aeronauts to observe the various heights at which birds are found. It is now supposed that the height above the ground at which birds fly does not generally exceed 400 meters, and only occasionally reaches 2,000 meters, the zone usually remaining below the lower clouds. Still, much uncertainty prevails concerning the tracks of birds, and especially the heights of flights, and information is greatly desired.

The fifth session was mostly devoted to a discussion of observations of atmospheric electricity and terrestrial magnetism in balloons. Dr. Hergesell explained that electrical measurements are of such vital interest that the academies of Berlin, Munich, Göttingen, Leipzig, and Vienna were to have been represented at this meeting by Professors von Bezold, Ebert, Wagner, Wiener, and Exner. The latter, who is the Nestor of this branch of physics, was prevented from attending, but Professor Elster, of Wolfenbüttel, was present among the experts. Professor Ebert, of Munich, said that constituents containing electrical charges had been found recently in the air through their physical properties. These carriers of electricity are called "ions," or, more correctly, "electrons." At the earth's surface their presence may be shown by the dissipation apparatus of Elster and Geitel, and the smallest quantity of electricity may be recorded by means of an electrometer. The speaker had adapted this apparatus for use in balloons, and by employing an aspirator a fixed quantity of air could be drawn over the dissipating body and absolute measurements made of the amount of free electricity contained in a cubic meter of air. It is of importance in geophysics to know how the capacity of the air for positive and negative electrons varies with altitude and therefore the speaker had made such determinations, finding near the earth many more positive than negative electrons, but whether this is a result of the negatively charged earth is uncertain. In the high strata the inequality tends to disappear, but considerations that throw doubt on the balloon observations relate partly to the electrical discharges produced by the ultra-violet light rays and partly to the indeterminate moment of aspiration in a rising or falling balloon. Professor Ebert considered the cooperation of aeronauts valuable, and cited as a result of the investigation in the Alps that in the foehn wind an excess of positive electrons is found and this disturbance of the electrical equilibrium perhaps may cause the foehn sickness. Professor Elster described two experiments that proved the existence of the electrons, one being the radiation of Becquerel rays after two hours from an insolated and stretched copper wire charged with 2,000 volts. It was agreed by both experts that the cleaner and clearer the air the more electrons it contains. Dr. Caspari, of Berlin, said he had ascertained, during a physiological excursion in the high mountains, that it was not so much the absolute number of ions as the preponderance of those of the same sign which had a physiological influence.

Dr. von Bezold mentioned an investigation of the relation between the foehn and richness in electrons that was undertaken, at his suggestion, by Professor Czermak, of Innsbruck, which showed that the air brought down by the foehn from above carries a greater quantity of ions into the lower air, and so, very probably, there is a similarity between sickness caused by altitude and the well known effect of the foehn on living organisms. In conclusion, Professor Ebert said that the quantity of electrons in the atmosphere seems to have no effect on bodies, but only the violent changes of equilibrium so acted, and therefore an interesting field in the measurement of the dissipation effect was opened for research in balloons. In response to a request from the Academy of Science, the committee resolved to undertake measurements of atmospheric electricity in the international balloon ascents. Professor Palazzo exhibited, for use in balloons, a modification of Exner's electrometer, that gave a continuous photographic record. Dr. von Bezold thought it very desirable that the observations in balloons should include measurements of dissipation as well as changes of potential at different heights. Dr. Linke, of Potsdam, reported the results of his electrical measurements in balloons up to a height of nearly 6,000 meters. Five of the ascents were to determine the fall of potential and six were to study the electrons. In brief, his conclusions were that there is an increase of positive electrons with height in every weather condition, but a relation of the good or bad conductivity of the air to its greater or less transparency. The vertical movement of the balloon introduces errors in the electrometer readings that can hardly be avoided and the speaker cautioned his hearers against intrusting the difficult measurements of dissipation to inexperienced observers. Professor Ebert then described an apparatus for determining in a balloon the horizontal magnetic intensity, which is an improvement of the Heydweiler instrument and permits changes of intensity to be measured without knowing either the astronomical or magnetic meridan. This has not only a high scientific importance but may be of practical importance as affording a method of determining the position of a balloon when within the clouds, or over the sea, or at night. Dr. Marcuse, of Berlin, exhibited a simple instrument that was recommended for general use, by which the aeronaut may ascertain his position from the altitude of either the sun or moon or two fixed stars.

Dr. Kassner, of the Prussian Meteorological Institute, suggested the application of kites and kite-balloons to a series of problems as follows:

Physics.—The measurement of the velocity of sound in the free air is important, in meteorology, for example, for the theory of thunder. It requires a knowledge of the density of the atmosphere and this must be calculated from the pressure, temperature, and humidity. Formerly these elements were determined at the ends of a base line, which ends were usually on mountain summits. The intervening air stratum can now be accurately investigated and, consequently, the measurement of the velocity of sound will be more accurate.

Geodesy and astronomy.—A knowledge of the conditions prevailing in the stratum of air traversed by the ray of light is needed for the computation of atmospheric refraction, and this can easily be obtained by a kite or a captive balloon.

Meteorology.—For studying the action of "hail shooting" registering instruments can be sent up on kites or on captive balloons to determine whether the aerial whirls produced by the hail-cannon really extend up to the clouds, a question that is still awaiting solution.

This completed the programme of papers, but Director Archenhold, of the Treptow Observatory at Berlin, called attention to the probable production, by the volcanic eruptions in the West Indies, of the same phenomenon of luminous dust-clouds in the highest air strata that were seen for years after the great outbreak of Krakatoa in 1883. If the development proceeds as it did then, we should have first brilliant and long-continued twilight phenomena, while the lower strata are filled with dust, and sometime afterwards the luminous clouds at a height of 80 kilometers. Since it is probable that aeronauts may first discover this phenomenon during high night ascents the speaker requested that it should be watched for and this was promised.

Before closing the Congress the resolutions proposed, after undergoing certain modifications, were adopted by the Committee in executive session, the Congress itself being only a con-

sulting and advisory body. Besides the resolutions mentioned already it was determined that the international ascents of balloons and kites during the next year should take place, as has been the case this year, on the first Thursday of every month and that at least one of the *ballons-sondes* liberated at any station should be sent up one hour before sunrise in order that its records may not be affected by solar radiation, and also that the balloon may be seen when it falls to earth in the early morning. The Richard thermograph, with Teisserenc de Bort's insulating device, should be used and the Hergesell instrument having a tube of German silver, instead of the Bourdon tube, filled with alcohol, was also recommended on account of its sensitiveness and durability. Ascensions at other hours and with different apparatus are discretionary. The president, Prof. Dr. Hergesell, in summing up the results of the Congress, which he regarded as eminently satisfactory, laid special importance on the meteorological kite flights that were proposed over seas, lakes, and mountains, and hoped that the British Government, by similar work in India, would help in the investigation of the great Asiatic monsoon region. A grant of money was requested from the German Government to enable the Prussian Meteorological Institute to cooperate with the writer in his proposed investigation of the atmosphere over the Atlantic Ocean. It was announced that in order to facilitate international researches in scientific aeronautics, the formation of an organization, sustained by the various European nations, would be attempted. The Congress was then closed with the usual votes of thanks.

ON THE CALIFORNIA CHARTS OF RAINFALL.

By ALEXANDER G. MCADIE, Professor and Section Director, United States Weather Bureau, dated August 20, 1902.

Referring to the symposium on "Rainfall and charts of rainfall," in the MONTHLY WEATHER REVIEW for April, 1902, I respectfully refer to the map published in the Annual Summary for 1900, of the California Section of the Climate and Crop Service, where it will be noted that in charting rainfall due allowance has been made for the topography of the State. The intimation by Mr. Henry Gannett, on page 224, that in preparing our rainfall maps we only consider the rain gage measurements, is hardly fair to the California service, for the reason that the isohyets in this State have, during the past three or four years, been drawn with special reference to the orography. We do not show the area of the precipitation over the Sierra Nevada to be the same as that measured at Fresno, Stockton, or Owens Lake. Mr. Gannett must have been unaware of the methods followed at this office in charting rainfall, and I will be glad to have his attention called to this matter, as I am sure that he will appreciate our method. A relief map of the State is always placed underneath the tissue paper chart of the State on which the rainfall data are assembled.

On page 225 Mr. F. H. Newell is likewise in error in his statement that the rainfall maps of the Weather Bureau, "while undoubtedly good for the more thickly settled parts of the United States are very misleading for the western two-fifths of the country because the great mountain ranges are ignored." On page 226 Mr. Newell suggests that some one familiar with the topography should sketch the rainfall map. It is believed that this is not nearly so good as the method which we have followed for years.

After carefully reading the symposium published in the MONTHLY WEATHER REVIEW on "Rainfall and charts of rainfall," I fail to see wherein the chart of precipitation published by the California Section can be improved under the present limitations of our knowledge. It would be unwise to make use of an indefinite factor based upon the element of forestation. Mr. Gannett's contention[1] that certain timber belts upon the Sierra Nevada might be utilized in drawing the isohyets fails to find support in the views of Professor Goodale, Professor Sargent, Professor Merriam, Professor Fernow, and our forester, Mr. Pinchot. To introduce such a factor would certainly make the map of rainfall in California, in the words of Dr. Hann, "a subjective work of the imagination." As an illustration of the uncertainties attending forest growth and its relation to rainfall I would call attention to a redwood grove on the windward side of Mount Tamalpais. The rainfall from May until October is nil, but below the crest of the mountain dense fog prevails in great blankets. The crowns of the redwood trees, averaging possibly 200 feet from the ground, are bathed in moisture for from five to eight hours nearly every day during the summer months. The character of the forest here is, therefore, largely determined by temperature, humidity, and shelter from high winds rather than rainfall.

With reference to Mr. Newell's contention that our rainfall records are not kept with that degree of accuracy which we profess (see page 226), I would say that in California we have many earnest rainfall observers who for long years have maintained records which I believe will compare favorably with any set of instrumental records maintained by any institution in the world. Our records show cases where observers have carefully measured the dimensions of their collectors and receivers, and finding a difference in the third or fourth decimal place from the figures given by our Instrument Division have reported the same to this office.

Again on page 225 Mr. Newell contends that our rainfall maps are misleading in that few, if any stations, can be used in accurately measuring the amount of water flowing from mountain streams. Possibly the methods employed in measuring the total volume of discharge of these streams for a year are at fault.

* * * * * * *

The hydrographer assumes that mountains necessarily cause a rainfall divide. In a State like California with mountain systems running at various angles to the prevailing air movement, and where wind circulations are frequently reversed with seasonal changes, the determination of average rainfall is a difficult problem. The greatest rainfall may or may not occur beyond the crest of a given range. Should it occur on the side of the divide farthest from the origin of the rain bearing winds any argument based upon elevation and the run-off in a given watershed would be untenable.

I have in recent conversation with Mr. Newell called his attention to the care with which the isohyets have been drawn in California, and I now understand that his criticism did not apply to California. We are indeed only too thankful to have our work criticized if the criticism shall lead to improvement.

In place of the suggestion of Messrs. Gannett and Newell that our rainfall charts be modified so as to "obtain the relations between the flow of streams, the altitude, the vegetation, and the rainfall" (see page 206), would it not be better to begin a systematic study of the forces at work in the formation of the raindrop? Then, possibly, we shall be able to discuss intelligently the true values to be allowed for the influence of forests, mountains, timber belts, etc. From the office of the Weather Bureau at San Francisco one can see day after day vast quantities of condensed water vapor passing inland, undergoing many changes and yet without resulting precipitation. Even if this fog and vapor could be measured it would be improper to allow for it in drawing the rain chart, and yet it plays an important part in modifying climate.

In conclusion, I repeat that the isohyets in California have been drawn with care, and as much allowance made for topography as the present state of our knowledge permits. Every effort will be made to maintain rainfall data of a high degree of accuracy. The criticism of our maps was made without a

[1] Page 206 Monthly Weather Review for April, 1902.

good knowledge of the methods employed in charting. The suggested modifications have not sufficient authority back of them to warrant consideration as factors in charting rainfall.

THE DATE LINE IN THE PACIFIC OCEAN.

By JAMES PAGE, United States Hydrographic Office, dated September 5, 1902.

In charting meteorological data from the various land stations in the Pacific Ocean confusion is apt to arise owing to the lack of uniformity on the part of the several island groups as to the calendar date employed. Certain of the islands to the westward or on the Asiatic side of the meridian of 180° employ the American date, while others to the eastward or on the American side of the meridian employ the Asiatic date, which is of course one day later than the American; 8 a. m. of Monday, June 9, in west longitude, becoming 8 a. m. of Tuesday, June 10, as soon as east longitude is attained, and similarly for other hours and days.

It is obviously desirable that local practise should, in this respect, conform as nearly as circumstances will permit with the astronomical rule which makes the date line follow the meridian of 180° throughout. At the present time the approximation is very close, although this has not always been the case. A notable exception was that of the Philippine Islands, which, prior to 1845, observed the American date; their discoverer, Magellan, having approached them from America, and the islands themselves having for many years maintained an active trade with Acapulco on the Mexican coast. The island of Celebes, on the other hand, in the same longitude as Luzon (120° E.), observed the Asiatic date. An event described as having taken place at 8 a. m. of Monday, June 5, in Philippine annals, would thus be described as having occurred at the same hour of Tuesday, June 6, in the annals of Celebes. To remove this incongruity the Manila authorities accordingly decreed that December 31, 1844, should be dropped from the calendar, December 30 being immediately followed by January 1, 1845. Prior to its purchase by the United States in 1867 the Asiatic (Russian) date was employed throughout the whole Territory of Alaska, while the Samoan archipelago clung to the Australian date until July 4, 1892.

At the present time the islands of the Pacific keep their dates, as shown in the following list, compiled from the Pilot Chart of the North Atlantic Ocean for September, 1899, published by the United States Hydrographic Office:

American date: Alaska, St. Lawrence Island, all the Aleutian Islands (Attu, the most westerly, is situated in longitude 173° E.), Morell Island, Phœnix Islands, Samoan Islands.

Asiatic date (one day later than the American date): Siberia, Kamchatka, Copper Island, Komandorski Island, Marshall Islands, Gilbert Islands, Ellice Islands, Fiji Islands, New Zealand, Chatham Island.

When it is Saturday the first day of the month throughout the islands on the eastern or American side of the date line it is Sunday the second day of the month throughout those on the western or Asiatic side, and this is true of any hour of the day or night.

In order to make their dates agree with those of their ports of call, it is the universal custom of shipmasters when westward bound to omit from the log the date immediately succeeding that on which the meridian of 180° is crossed, and when eastward bound to repeat this date, notice of this fact being given and events on board dated accordingly. In the case of simultaneous observations aboard such vessels, the matter is further complicated by the fact that, in addition to this change of date, the local time is constantly changing. The United States Hydrographic Office has for several years past been engaged in the construction of daily synoptic weather charts of the North Pacific Ocean, showing the barometric pressure, the force and direction of the wind, the proportion of cloudy sky, etc., prevailing each day at the hour of mean noon on the meridian of Greenwich, the basis of these charts being the daily simultaneous observations taken at this hour aboard the ships scattered over the entire ocean. As a vessel approaches the meridian of 180° from the eastward, the hour of observation, which is the local or ship's time corresponding to Greenwich mean noon, becomes successively earlier and earlier, and, upon crossing the meridian, changes from a. m. of the given date to p. m. of the next immediate following date. To illustrate by an example, assume that a vessel westward bound and making four degrees of longitude daily, finds herself at the instant of Greenwich mean noon of June 15 in longitude 179° west. The local date and time of the meteorological observation will be June 15, 0 h. 4 m., a. m. The meridian of 180° will be crossed about 6 a. m. of June 15, which, by virtue of crossing this meridian, immediately becomes 6 a. m. of June 16, and the local date and time of the next Greenwich mean noon meteorological observation (the vessel having reached 177° east), will be June 16, 11 h. 48 m. p. m. Many observers, however, mindful of the necessity of dropping a day from the ship's local record, consider it essential to drop a day from the Greenwich mean noon record, and (incorrectly) date the second observation June 17, 11 h. 48 m. p. m., and likewise all subsequent observations throughout the voyage one day in advance of the actual date. The same error, but with opposite sign, is of equally frequent occurrence in the case of eastward bound ships, all Greenwich mean noon observations subsequent to crossing the one hundred and eightieth meridian bearing date one day behind the truth. In tabulating or plotting simultaneous meteorological observations at sea it is therefore highly essential to carefully scrutinize the record in this respect.

French vessels reckon their longitude from the meridian of Paris (2° 20′ east of Greenwich) and change their date upon crossing the meridian 180° distant from this, i. e., in longitude 177° 40′ west of Greenwich.

Spanish vessels reckon their longitude from San Fernando (6° 14′ west of Greenwich) and would naturally change the date in longitude 173° 46′ east of Greenwich. The number of vessels of Spanish nationality engaged in this trade is, however, small and it is impossible to speak with precision as to their custom in this respect.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—On the Pacific slope the precipitation was deficient and irregularly distributed. In San Jose the pressure was about normal, the temperature slightly below the average, and the rainfall 163 mm. against a normal of 241 mm. The sky was generally cloudy, with only 103 hours of sunshine, the normal being 119 hours. The prospects for the next coffee crop are poor. On the Atlantic slope the rainfall was generally in excess of the normal, occasioning everywhere inundations and landslides.

Notes on earthquakes.—July 5, $5^h\ 17^m$ a. m., slight shock, NW–SE, intensity III, duration 9 seconds. July 8, $3^h\ 03^m$ p. m., very light shock, NW–SE, intensity I, duration 3 seconds. July 8, $11^h\ 51^m$ p. m., light shock, NNW–SSE, intensity II, duration 9 seconds. July 18, $11^h\ 24^m$ a. m., tremors. July 19, $9^h\ 05^m$ p. m., pretty strong shock, E–W, intensity III, duration 9 seconds. July 22, 4^h p. m., very light, NW–SE, intensity I, durations 4 seconds. July 25, $11^h\ 25^m$ a. m., slight, N–S, intensity II, duration 4 seconds. July 29, $8^h\ 05^m$ p. m., very slight, E–W, intensity I, duration 4 seconds. Contrary to newspaper reports the Costa Rican volcanoes have become quiet, and there are absolutely no indications of unusual activity.

NOTES AND EXTRACTS.

METEOROLOGY IN HAWAII.

The Pacific Commercial Advertiser, Honolulu, Hawaii, January 1, 1902, contains several interesting articles descriptive of the agricultural and commercial industries of the Territory of Hawaii. Naturally, in connection with these industries, the climate receives attention, and on this subject a special article was contributed by Mr. Curtis J. Lyons,[1] Territorial Meteorologist, already known to the readers of the MONTHLY WEATHER REVIEW through his monthly climatological reports.

We quote the following from Mr. Lyon's article, including, however, numerous corrections and additions which he has kindly made in the original text:

The local government meteorological work began in 1881 in a very small way, as a voluntary service in connection with the government survey, superadded to the surveying duties of the office. First the barometer and later the temperature, wind, and cloud observations were made. Instruments were standardized by comparison with those of scientific government parties visiting Honolulu. In 1883 rainfall records were undertaken, and the present station at 1508 Alexander street, Punahou (see fig. 2, No. 1), was occupied. In 1890, by direction of the then Minister of Interior, Lorin A. Thurston, the systematic collection of rainfall data was begun, many of the observers taking up the matter in response to letters from the minister himself. There are now about eighty stations reporting rainfall. At the same time the weekly publication of a summary, which appears on the last page of the Advertiser and also in the Gazette, was instituted and continues to this day.

At about the same time the study of the humidity of the atmosphere was taken up. Previous to this few really accurate humidity observations had been made anywhere, even in Europe and America, owing to crudities in practise; and even now the moisture is apt to be overestimated.

In the early nineties the United States Weather Bureau and the Hydrographic Office both requested to have detailed records sent them, which has been done regularly.

For three years past the leading papers have been furnished by telephone with the daily weather items, including the dew-point and humidity. The effort to furnish forecasts for short periods was taken up at the request of the papers themselves, and has proved in a measure successful. Of course, there is no background to the west to draw information from by telegraph, as on the mainland. Should a cable be laid to Midway Island, it would be of service in the winter time, as the winter storms and changes come from that direction.

The annual reports for six years, viz, 1892–1897, inclusive, were published. Copies of all but 1892 can still be had. The reports for 1898 to 1901 are soon to be published and will be accompanied by a pamphlet containing the monthly rainfall for every station occupied previous to 1897 for the entire period of observation up to the end of 1900.

[1] In connection with this article the following note was published:

Curtis J. Lyons was born at Waimea, Hawaii, in 1833, his parents being members of the missionary band that arrived the year previous in the whaleship *Averick* from New Bedford. His father, the Rev. Lorenzo Lyons, was a man of very considerable attainments and has been considered preeminently the lyric poet of Hawaii.

In 1850, after a three years attendance at Punahou College, he joined the land commission for locating Kuleana and land grants, remaining with them for three years during which time he acquired an extensive knowledge and acquaintance with the early land system, which has been of the greatest value to the department and governments ever since. The money he had earned enabled him to enter Williams College in Massachusetts, from which he was graduated in 1858. He then applied himself to the study of theology, but at the end of two years his health failed, compelling his return to the islands, where he recovered in due time. He then entered the newspaper field, working on both the Kuokoa and Advertiser as translator and editorial writer. He was also a member of the legislature during two sessions. He joined the government survey service in 1871 and is still connected with that department. Since 1896 he has been Territorial Meteorologist.

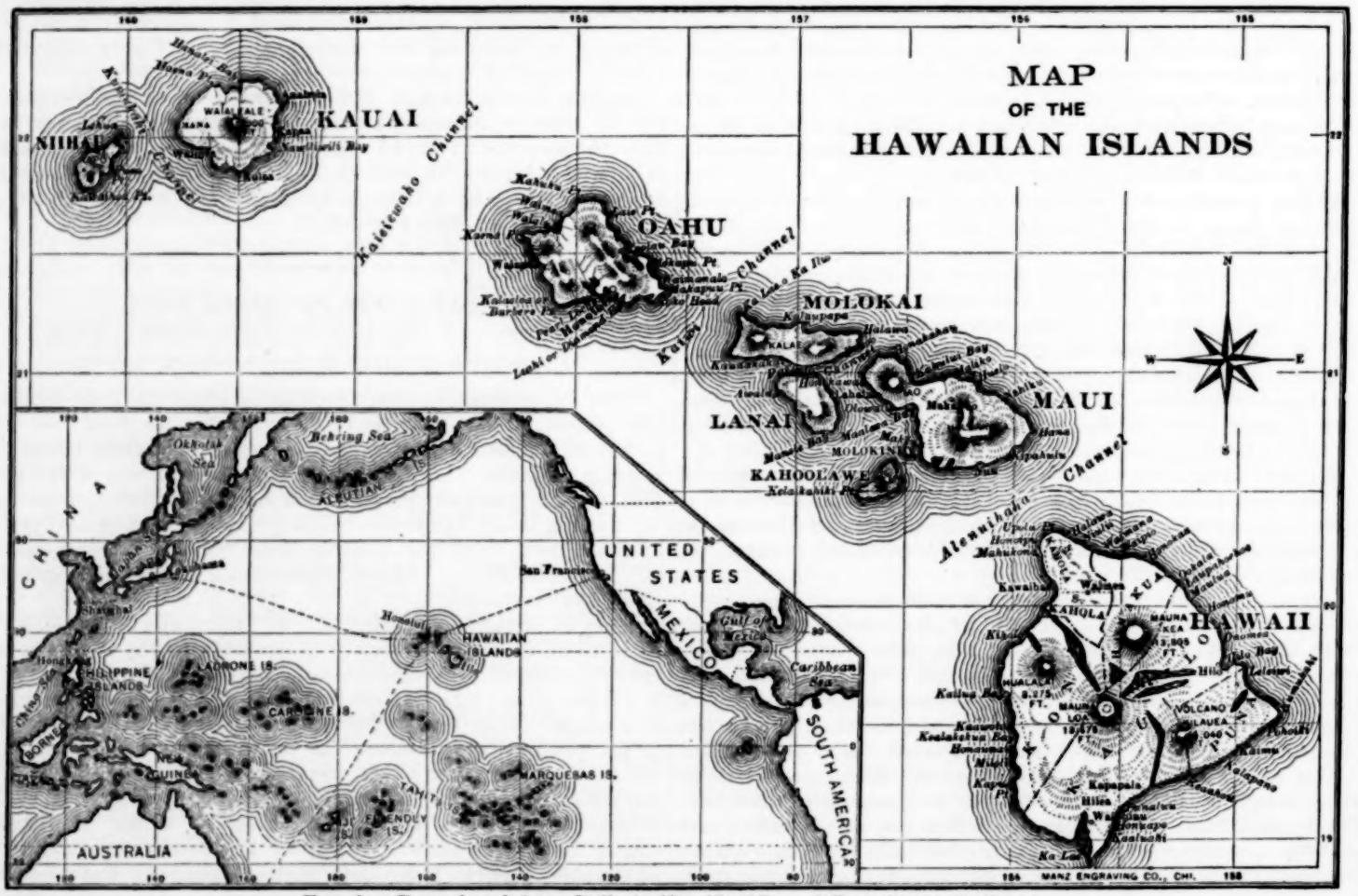


FIG. 1.—(Reproduced from Bulletin No. 95, Office of Experiment Stations.)

CLIMATOLOGY OF HAWAII.

As to the results: The mean annual temperature of Honolulu, Oahu, at sea level is 74° F., and the annual departures from this mean are not over a degree. The mean of 6 a. m., 2 p. m., and 9 p. m. temperatures is taken as the standard average, the mean of the maximum and minimum being about 0.7° too high. It is commonly supposed that the temperature on the windward side of the islands is much less than on the leeward side, but it is doubtful whether any place at sea level is over a degree cooler than Honolulu. While the temperature in the West Indian Islands has no doubt been over estimated, yet the mean is probably not less than 78°, being 4° higher than here, which is quite a difference for the Tropics.

The temperature diminishes with elevation by ratios that vary with the locality; sometimes it is as rapid as 1° F. in 200 feet, and again it is only 1° in 400 feet. Probably 1° in 300 feet is a fair average.

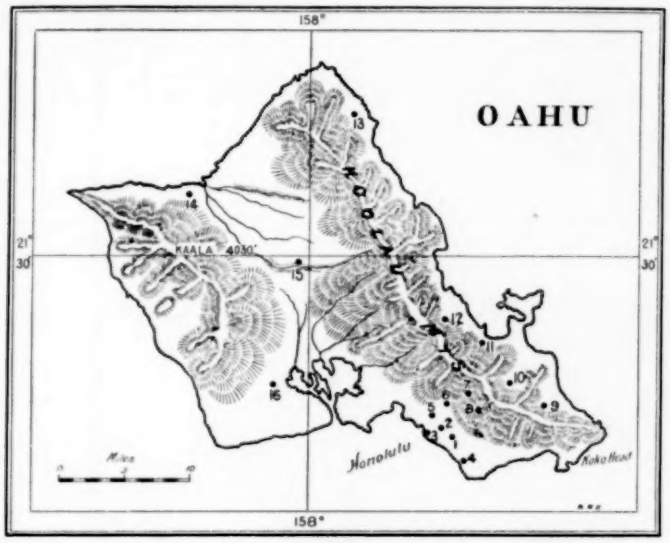


FIG. 2.

No.	Station.	Elevation, feet.
1.	Punahou (Weather Bureau)	47
2.	Kulaokahua (W. R. Castle)	50
3.	United States Naval Station	6
4.	Kapiolani Park	10
5.	Nuuanu (Hall)	50
6.	Nuuanu (Electric Station)	405
7.	Nuuanu (Luakaha)	850
8.	Manoa	300
9.	Waimanalo	25
10.	Maunawili	300
11.	Kaneohe	100
12.	Ahuimanu	350
13.	Kahuku	25
14.	Waialua	20
15.	Wahiawa	900
16.	Ewa Mill	60

The daily range of temperature at Honolulu averages 11°; at greater elevations it averages from 15° to 16°, while at Pepeekeo, Hilo, (see fig. 3, No. 3) on the windward coast of Hawaii it is only 7°. The monthly mean temperature at Honolulu ranges from 70° in January to 78° in July and August. The extreme temperatures are generally 54° and 88°. In rare instances 50° and 90° have been recorded.

Variations in the humidity have more effect upon what is termed the sensible temperature than does the temperature itself. The thermometer at 80°, with the dew-point at 62° to 64°, gives a very comfortable atmosphere; at 75°, with the dew point at 70° to 72°, it is decidedly oppressive. Rapid evaporation in the first instance cools the skin and frees the lungs; in the other case the lack of it blocks the pores and the cells. A sudden fall in the dew-point is only bracing to the strong, since it causes sensitive people to take cold. The average dew-point at Honolulu is 64°; the average absolute humidity, 6.6 grains of moisture per cubic foot; and the relative humidity or percentage of saturation, 72 per cent, which is no higher than that of maritime cities on the mainland.

The trade winds blow here on an average 260 days in the year. A good deal of what is called south wind is merely sea breeze. There is sometimes a land breeze at Honolulu; it is very light and comes from the Ewa Mountains. The disturbances in the winter time are mostly caused by the southern edges of the great circular or revolving storms that cross the Pacific Ocean from Japan to the American coast, passing well to the northward of Hawaii. Some such storms come up from the southwest, and are probably the genuine "Konas," which are rare. November and February have the heaviest rain records. December and January are sometimes very delightful months and sometimes quite the contrary. The character of the winter depends on the belt of latitude on which the storms move.

Much interest attaches to the rainfall of the islands because of the marked variations in the amount with the locality. We will accept the fundamental principle in rain science that when moist air ascends from sea level to a high altitude it cools and has to part with some of its water, i. e., it rains. In Oahu (see fig. 2, Nos. 1, 2, 3, 4) the winds strike the Koolau Mountains, Konahuanut, etc., and shoot upward and onward, giving 120 inches of rainfall a year at Luakaha, in Nuuanu Valley (see fig. 2, No. 7). On the other hand, the wind comes around Koko Head and over Waialae and Kapiolani Park (see fig. 2, No. 4) without being deflected upward, and the rainfall there is hardly 20 inches a year.

For the same reason the huge mountains, Mauna Kea and Mauna Loa, Hawaii, cause the heavy rains of Hilo and Olaa (see fig. 3, Nos. 2 and 26), averaging at different points from 100 to 200 inches annually. Nahiku, Maui (see fig. 4, No. 6), 1,600 feet elevation has the record for authenticated monthly rainfall, viz., 102.46 inches; Wahiawa Mountain, on the south side of Kauai (see fig. 5, No. 6), has the annual record, viz., 250.58 inches for 1901. Laupahoehoe, Hilo (see fig. 3, No. 6), has the greatest short period record, 41.30 inches in twenty-eight hours. Some places on the lee coast of Hawaii probably do not have over 8 inches of rainfall per year. The Kona forest belt, on the west side of the island of Hawaii, has its rainy season in July and August. This is exceptional and is caused by the combination of the sea breeze and back current of the trades, which carries the sea air up the western mountain slope.

The balmy character of Hawaiian atmosphere is largely due to the fact that the supply comes from a high elevation. That is, the air is carried to the equator by the trade winds there rises, parts with its moisture in the heavy rains of that belt, returns overhead as the southwest upper current, descends to sea level at about latitude 30°, and comes down to us as the fresh northeast trade.

Hawaiian meteorology is therefore not the monotonous subject that it appears at first glance.

Table 1 illustrates very clearly the temperature conditions in Honolulu. The diversified surface of the country often causes slight differences of temperature even in places having the same elevation and the same average temperature. This is particularly true on cool mornings when the temperature opposite the mouth of a valley often is two or three degrees lower than that opposite the foot of a ridge. Again, a heated hillside to windward of a station will make it warmer than others at midday, although it may be the cooler in the early morning.

THE SUGAR INDUSTRY.

The relation of climate to the sugar industry of the islands is illustrated by the following extracts:

THE SOUTH KONA AGRICULTURAL COMPANY.

The location of this company is in South Kona, island of Hawaii. (See No. 29, fig. 3.)[1]

Cane in small patches has been grown on these lands from time immemorial. For the past three years it has been grown in acre quantities, and 350 acres are now under cultivation on this plantation. The growth shown is absolutely phenomenal. Without steam plowing, fertilizing or irrigation, and with but little attention, the growth, weight, and analysis of the cane shows a yield of 6 tons of sugar and upward per acre.

The rainfall of South Kona is ample for all vegetation, no irrigation being required for any purpose, even taro, essentially a water plant, grows luxuriantly. The rainfall is also distributed with great evenness throughout the year, as will be seen by the following records of rainfall on the plantation lands:

One of the peculiar advantages of this district for purposes of cane culture is the fact that there is practically no wind. It is so sheltered by high mountains that the trade winds never reach it, and the gentle land breeze at night and sea breeze in the daytime are the only winds, except during brief periods in the winter months. This has an important bearing on the growth of cane, as wind more than sun dries up moisture, and high winds break down, destroy, and stunt much cane in windy districts.

TABLE 2.—*Rainfall at Kalahiki, South Kona agricultural plantation (29, fig. 3.)*

	1895.	1896.	1897.		1898.		1899.		1900.	1901.	
	750 feet.	750 feet.	750 feet.	1,200 feet.	750 feet.	1,200 feet.	750 feet.	1,200 feet.	750 feet.	750 feet.	1,800 feet.
January	.....	.....	0.61	1.18	1.34	1.49	1.71	2.22	1.80	1.50	2.15
February	.....	0.89	3.04	2.68	1.27	2.63	2.72	3.28	1.89	10.50	13.20
March	.....	2.87	1.07	3.38	3.68	4.77	4.18	6.77	2.93	5.74	10.30
April	.....	1.86	2.45	1.78	6.80	9.18	4.22	7.29	2.20	5.47	12.15
May	0.84	6.67	2.20	2.61	2.17	3.41	7.16	10.12	1.80	10.90	27.80
June	3.98	2.81	5.53	4.85	4.74	8.27	4.55	5.60	2.51	3.66	8.61
July	4.66	2.95	5.52	7.15	2.59	5.25	6.07	4.58	4.17	4.15	10.63
August	4.72	2.37	2.63	8.26	3.33	4.78	5.01	8.78	5.31	5.28	5.84
September	5.14	2.01	6.93	4.06	2.29	7.34	3.63	5.40	3.60	3.29	6.83
October	2.83	4.82	3.50	9.11	1.69	4.06	2.51	2.21	4.98	2.49	5.05
November	9.10	0.79	1.62	5.02	4.48	8.18	2.15	5.10	3.17	3.13	5.29
December	5.95	3.79	2.20	3.07	1.88	5.92	0.50	1.05	1.79	.....	.....
Total	37.22*	31.83	37.26	55.15	36.32	65.28	44.41	62.30	37.15	56.13*	107.85*

*Unfortunately the records for a few months have been lost (before South Kona Agricultural Company owned the place), and in 1900 the 1,200-feet altitude gage broke and was not replaced; the 1,800-foot gage has been selected as averaging better with the 750-foot gage. Returns for December, 1901, could not be had before going to press.

[1] The station is apparently about 10 miles south-southeast of the location given in fig. 3.—ED.

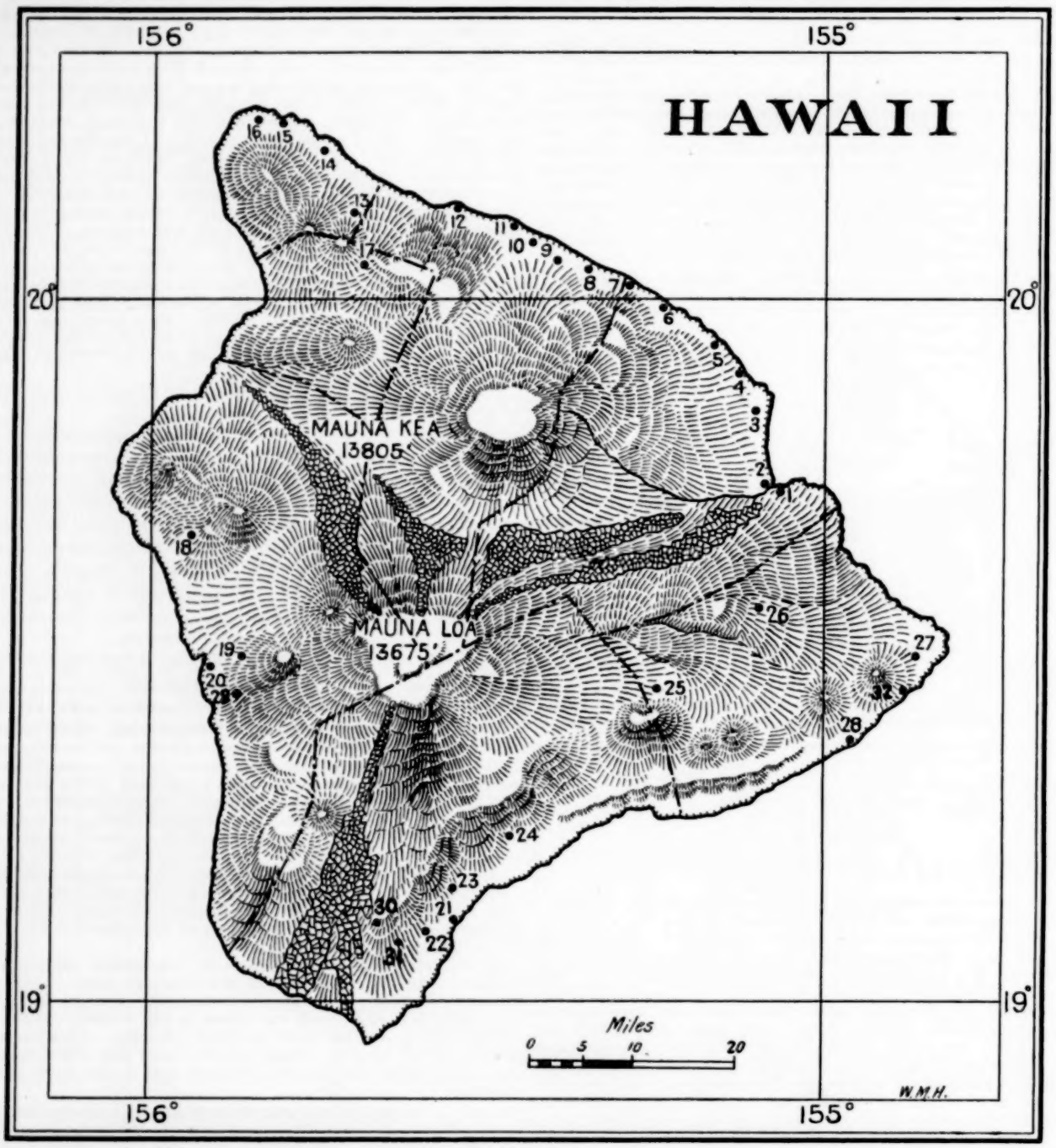


FIG 3.—HAWAII.

No.	Station.	Elevation, feet.
	HILO, e. and ne.	
1.	Waiakea	50
2.	Hilo (town)	100
3.	Pepeekeo	100
4.	Hakalau	200
5.	Honohina	300
6.	Laupahoehoe	500
7.	Ookala	400
	HAMAKUA, ne.	
8.	Kukaiau	250
9.	Paauilo	750
10.	Paauhau	300, 1,150
11.	Honokaa	425, 1,900
12.	Kukuihaele	700
	KOHALA, n.	
13.	Awini Ranch	1,100
14.	Niulii	200
15.	Kohala	235, 521
16.	Hawi	300, 600
17.	Waimea, e	2,720
	KONA, w.	
18.	Kailua	950
19.	Kealakekua	1,580
20.	Napoopoo	25
29.	Kalahiki	750, 1,200, 1,900
	KAU, se.	
21.	Honuapo	15
22.	Naalehu	650
23.	Hilea	310
24.	Pahala	850
30.	Kahuku Ranch	1,680
31.	Waiohuna	1,000
	PUNA, e.	
25.	Volcano House	4,000
26.	Olaa	1,700
27.	Kapoho	110
28.	Kalapana, se	8
32.	Poholki	.....

THE PUNA SUGAR PLANTATION.

The district of Puna on the island of Hawaii (see fig. 1) is the most tropical and the least known of any section of the islands. The fact of its intensely tropical character prevented its becoming known, for, with the exception of a narrow rocky strip at the sea shore, the greater part of the district is covered by a dense and luxuriant growth of trees, ferns, and creepers, which are impenetrable except with the aid of a gang of men wielding axes and cane knives. Thousands of acres of tree ferns from 10 to 40 feet high, with trunks from 2 to 4 feet in diameter are still standing in Puna. There are more cocoanut and bread fruit trees in Puna than in all the remainder of the territory put together. Thousands of bushels of the finest guavas that grow go to rot in the district every year, while wild bamboo, awa root, yams, and mangos are common.

Because the narrow strip at the beach and some ancient lava flows, that were in sight, were rocky, it was taken for granted that the whole district was rocky, and until ten years ago it was in the undisturbed possession of a few ranchmen and natives who lived in primitive simplicity.

The climate is of more importance to a sugar cane plantation than soil, for if there are droughts, artificial irrigation must be practised, immensely increasing the expense. If there are even occasional "dry spells," or interruptions for only a month or so in the rainfall, it stunts the cane and greatly reduces the yield of sugar.

A drought is absolutely unknown in Puna. It rains on the Puna plantation, without fail, every month in every year, sufficiently to keep up a strong and steady growth of sugar cane. The official record of rainfall for this portion of the district has been kept since 1892, and is shown in Table 3.

TABLE 1.—*Record of temperature for 1901 in Honolulu, territory of Hawaii, kept by W. R. Castle,* altitude 50 feet.*

Day of month.	January.			February.			March.			April.			May.			June.			July.			August.			September.			October.			November.			December.		
	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.	6 a. m.	1 p. m.	9 p. m.
1	66	77	67	63.5	73	61	68	79	74.5	72	82	73	70	80	72	74	84	72	74.5	86	76.5	73	86	75	75	85	74	73	80	73	72	84	71	64	80	73
2	61	74.5	64.5	58	75	68	73.5	71.5	68	70	80	71	71	80	72	73	84	75	76	85	76	73.5	85	76	76	85	78	72	77	73	69	85	73	69.5	80	70
3	62	73	67	67	76	68	68	74	68	69	81	71	71	81	73	75	85.5	75	75.5	86	77	73	84	76	74	84	77	70	80	75	71	81	71	70	79.5	73.5
4	66	77	68	69	74	72	68	74	69	67	80	72	73	82	74	73.5	84	70	75	86	76	69	84	75.5	76	86	76	70	79	73	71	82	75	73	78	74
5	65	77	68	68	72	72	69	76	71	70	78	72	75	80	73	67	87	65	75	85	73	75	85	77	73.5	87.5	75	70	83	75	71	81	75	74	78.5	73
6	65	76	69	70	74	73	69	74	67	70	80	70	70	83	72	73	83	75	68	84	72	72	85	77	72.5	86	77	74	83	73	70	78	72.5	71	79.5	71.5
7	68	79	73	68	76	70	70	76	72.5	69	78	69	71	82	71	74	81.5	72.5	68.5	86.5	74	75	86	75	74	85.5	76	70	82	76	70	74	73	66.5	79	71
8	70	78	72	67.5	69	70	71	78	71.5	67	80	70	70	80	68	69	81.5	75.5	74	86	78	70	84	74	70	88	74	73	83	74	73	76	75	69	73	69
9	70	78	72	70	72	70	67.5	76	69.5	68	79	69	67	83	72	74	84	76	75	87	76	72	87	77	73	86	75	73.5	83	75.5	74	74	75	64	78	67.5
10	69	76	74	70	73	71	68	77	71	69	79	73	71	81	72	74	83	74	76	85	77.5	75	88	77	69	84	76	71	83	72	75	78	75.5	65	77	68
11	70	76	69	69	75	73	70	78	72	71	82	73	71	84	75	74	82.5	76	76	81	75	77	86	78	73	85	77	68	81	74	74	79.5	74	68	76	69
12	61	76	72	70	74	72	70	79	71	71	81	70	76	85	76	77	84	74	74	82	75	77	87.5	75	75	86	76	68	81	72.5	74	79	74	68	75	67
13	68	70.5	68	70	68	64	66	80	72	68	80	71	73	83	73	71	83	72	72.5	84	76	74	85.5	76.5	73	84	75	72	80	76	70	77	72	59	76	73
14	71	76	72	59	70	63	67	79	70	69	79	72	72	83	71	72	83	77	74	86	76	75	86	75.5	73	84	75	70	82	75.5	69	76.5	72.5	73	78	73
15	66	77	68	63	74	67	68	78	71	69	78	72	68	84	76	73	86	75	73	85	75.5	70	86.5	77.5	72.5	83.5	74	68.5	84	73.5	72	78	72	72	79	74
16	65	78	71.5	65	74	68	67	78	68	71	79	71	73	80	75	75	84	76.5	73	85	75.5	71	86.5	76	69.5	83	71	69	81	73	71	77	73	74	79.5	76
17	69	72	67	65	72	64	69	79	72	71	80	73	74	83	76	76.5	84.5	76	74.5	86	77	70	85	75	67	83	71	71	83	73	73	78	72	75	79	76
18	67	73	68	57	71	64	71	77	70	72	80	70	74	83	76	76	86	76	74.5	86	76	69	89	76.5	68	85	76	70	86	74.5	70	80	71	73	76	71
19	67	74	67.5	60	72.5	63	69	79	71	68	80	70	76	85	76	75	85.5	75	75	86	75	72	85	76.5	76	85	76	68	82	73	71	80	73	70	79	67
20	68	75	71.5	63	76	69	68	79	72	67	78	68	74	83	75	75	81	76	74	85	74	72	86.5	77	75	84	75	67.5	83.5	74	68	81	71	65	79	69
21	70.5	76.5	72	60	73	63	70	78	69	70	79	69	73	82	74	76	86	76	72.5	85	74	75	86	78	71	81	72	67	83	74	67	80.5	70.5	66	78	69
22	70	76	71	58	73	68	68	82	70	68	81	71	71	82	72	74	86	76	75	83.5	76	76	84	75	71	84	76	69	81	73	67	80.5	70.5	68	68	66
23	68.5	77	71	67	75	64	70	80	72	67	80	70	70	83	74	73	83	75	69	85	75.5	74	85	77	73	84	77	72	82	75	72	80	70	64	76	74
24	71	77	68	60	72	66	72	82	74	71	84	73	70	82	74	75	84	72	71	80	75	77	85.5	78	68	84	77	70	82	74	72	79.5	71	69	71	67
25	64	77	68	59	76	66	72	82	74	71	82	72	71	85	74	73	85.5	71	69	84	76	74	83	78	72	85	77	70	81	74.5	69	78	69.5	67	74	69
26	64	77	69	66	76.5	72	71	79	71	70	84	68	73	85	75	68	86	76	75	84	77	73	85	76.5	69	84	72.5	70.5	80	76	67	77	69.5	67	78.5	69.5
27	69.5	76	69	65	78	71	69	79	67	71	80	74	71.5	86	73	72	84	76	75	83	76	74	84	76	71	83	72.5	73	82	76	69	79	66	68.5	77	69
28	65	77	68	66	78	68	63	75	63	63	80	70	70	82	74	76	85	74	75.5	85	76	76	84	76	70	84	75	76	83	76	65	79	68	67	73	67
29	66	77.5	69	....	....	....	67	78	70	68	80	72	72	82	75	73	85	76	75	84	76.5	76	86	78.5	68	83	73	75	78	77	66	78	69	67	71	66
30	64	77	66	....	....	....	66	83	72	72	78	69	72	83	74.5	75	85	76.5	73	83	76	78	86	78	68	84	74.5	72	86	78	65	78	65.5	66	71	66.5
31	62	74	66	....	....	....	73	81	74	....	....	....	68	84	73	....	....	....	72.5	82	76.5	77	85	77	....	....	....	73	88	76	....	....	....	66.5	72	66.5
Monthly average.	70.6			68.9			72.4			73.4			75.4			77.4			77.9			78.6			77.1			75.7			73.6			71.6		
Total rainfall....	2.44			7.70			3.40			2.15			2.45			0.98			0.59			0.54			0.47			3.56			2.90			9.52		

Total rainfall for the year 36.70 inches.

Temperature averages for each year: 1889, 74.21°; 1890, 74.05°; 1891, 73.81°; 1892, 74.39°; 1893, 73.86°; 1894, 73.08°; 1895, 74.26°; 1896, 74.03; 1897, 74.15°; 1898, 74.20°; 1899, 74.49°; 1900, 74.47°; 1901, 74.42°; thirteen years, 74.11°.

* Mr. Castle's station is at No. 2 on fig. 2. The hours of observation for 1901 probably relate to the adopted standard legal time, which is that of the meridian of 157° 30′ west: Honolulu is in 157° 50′ west.

TABLE 3.—*Record of rainfall, in inches, at Kapoho station (see fig. 3, No. 27), now Puna plantation, 1892 to 1899.*[2]

Month.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
January	13.45	2.55	22.35	1.34	5.43	5.41	15.64	2.83
February	3.95	10.05	24.79	6.45	6.80	3.36	11.41	7.29
March	5.69	9.63	9.60	3.24	10.29	6.18	24.86	8.77
April	2.52	11.88	4.30	8.21	6.89	3.25	3.26	9.40
May	2.33	7.62	1.11	5.58	5.55	2.76	4.17	8.37
June	5.92	4.04	2.75	4.83	2.57	2.59	4.19	6.45
July	6.10	3.54	3.82	6.11	3.02	4.77	4.99	1.65
August	6.15	2.12	2.45	5.94	5.13	5.31	4.12	5.60
September	5.18	3.09	5.09	9.46	4.58	5.99	6.55	2.90
October	9.50	5.44	6.80	9.62	4.28	7.13	6.11	15.48
November	5.20	18.42	7.28	8.64	4.24	12.41	7.22	2.46
December	5.50	5.64	8.48	12.20	4.01	9.74	4.05	3.19
	71.49	83.92	98.82	83.41	62.89	68.90	96.57	74.39

This table shows that irrigation of the sugar cane is never required, and that the continuous and even application of rainfall produces a steady, continuous growth, most conducive to the production of weight and quality of cane.

MEDICAL CLIMATOLOGY.

The climate of Hawaii from a medical point of view has been very interestingly described by Titus Munson Coan, A. M., M. D., in Cohen's System of Physiologic Therapeutics, Vol. IV, pp. 223–241. He finds it especially beneficial to invalids suffering from overwork or exhaustion, as also to the aged and the very young. We quote the following paragraphs:

Temperature.—The Hawaiian has no word for 'weather.' For warm and cold, wet and dry, fair and rainy, and in general for the visible phenomena of the world he has a full nomenclature; but the generic word, a coinage of more variable climates than his own, he does not need. The Hawaiian climate, in a word, is the only tropical climate that is never oppressively hot. Its equability at comfortable temperatures, and its absolute exemption from tornadoes and cyclones, distinguish it from all other warm climates of which we have record, not only from continental climates, like those of California and our Southern States, but also from those of other islands; as from Jamaica and the Bermudas, with their great range of temperatures, from Samoa and Tahiti, with their excessive heat and liability to cyclones, and from the Sundas and the Philippines, with their terrible typhoons, where for half the year the mercury never goes as low as 80° F.

Winds.—The prevailing winds are the northeast trades, at a temperature of about 70° F., and a saturation of about 65 per cent, but these are greatly modified by the mountain masses. Prof. C. J. Lyons, the accomplished observer in charge of the Hawaiian Weather Service, classifies the Hawaiian winds under five heads, as follows:

1. Trade winds of the weather side exposure, the districts of Hamakua and North Hilo on Hawaii, Wailuku on Maui, and Koolau on Oahu. In these districts there is considerable rainfall and a brilliant vegetation.

2. The leeside trade winds, as in Honolulu. The moisture is largely precipitated upon the mountains, but these are not high enough, from 3,000 to 4,000 feet, to keep the wind from sweeping over the ridges and

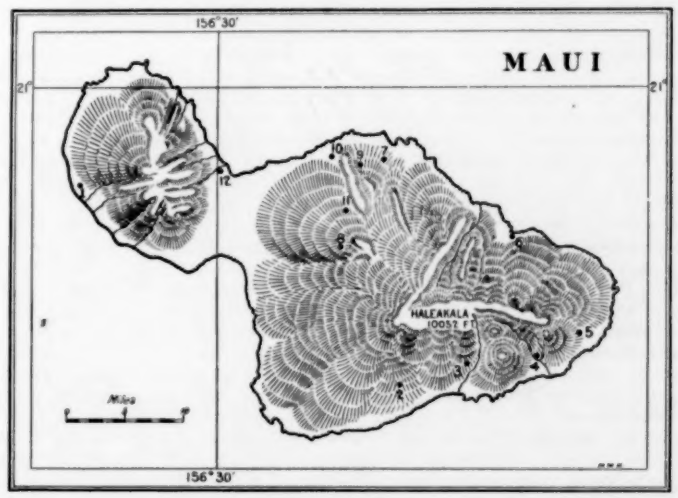


FIG. 4.

No.	Station.	Elevation, feet.	No.	Station.	Elevation, feet.
1.	Lahaina	....	7.	Haiku	700
2.	Waiopae	700	8.	Kula	4,500
3.	Kaupo	285	9.	Puuomalei	1,400
4.	Kipahulu	300	10.	Paia	180
5.	Hamoa	60	11.	Haleakala Ranch	2,000
6.	Nahiku	60, 800, 1,600	12.	Wailuku	200

[2] This record was taken near the sea beach, being the point of least rainfall of any on the plantation. The rainfall on the upper part of the plantation, 5 miles inland, is from 110 to 135 inches a year.

through the deep valleys. By night there is a very gentle land breeze. The trades bring little rain to Honolulu, and the southern slopes of Oahu are arid in comparison with those of the windward side. The winter storms from the southwest, however, make up the needed rainfall.

3. Strong trade wind exposures, at the north and south capes of the islands, as northwest Kohala on Hawaii, Kaupo on Maui, and the south side of Molokai. Here the trades blow uninterruptedly, drearily, endlessly.

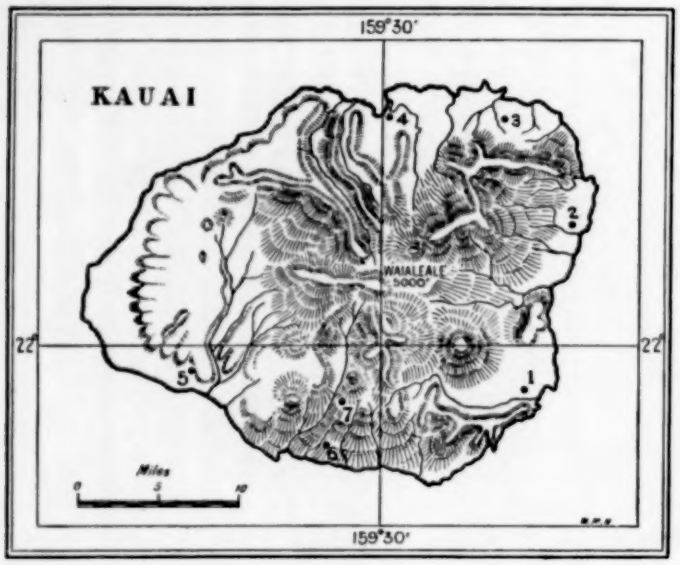


FIG. 5.

No.	Station.	Elevation, feet.	No.	Station.	Elevation, feet.
1.	Lihue	200, 300	5.	Waiawa	32
2.	Kealia	15	6.	Eleele	200
3.	Kilauea Plantation	325	7.	Wahiawa Mountain	2,100
4.	Hanalei	10			

4. The region of alternating land and sea breezes, viz, Hilo Bay and its neighborhood. To the north of Hilo Bay the trade wind divides into two streams, one flowing westward over Hamakua, the other southward, and very gently, often not reaching Hilo Bay until about noon. By night a well-marked land breeze flows down from Mauna Kea, lowering the temperature 10° to 15°. Stormy winds from the north occasionally arise, but in Hilo any strong wind is rare; the southwest gales felt on the other islands are seldom known here. The north wind is the stormy wind; it brings heavy rains. "It is, no doubt, the incessant meeting of the warm vapor from seaward with cool masses of air from the mountains (Mauna Kea) that produces the world-renowned precipitation of Hilo, from 100 to 200 inches per year. An engineer told me he had known a sixteen-inch-deep sugar cooler in the open air to be filled in one night."

5. The leeside land and sea breeze district, viz, the greater part of western Hawaii and of southern Maui. In these regions the sea breeze comes in regularly at about 9 a. m., blowing inland; and as regularly, soon after nightfall, comes the land breeze. From Kawahae to northern Kona, or over the northern part of the coast first mentioned, the "mumuku" also prevails, a violent downrush of trade winds across the northern promontory of the island, abolishing all the local currents for the time being.

The trade winds are regarded by the foreign residents as especially healthful. But a trade wind winter is not a healthy season, being abnormal, and "sickness and mortality, especially among native Hawaiians, are greater than when the regular southerly wind is in due proportion. Much as has been said against the hated south wind, nothing affects the native worse than the north or northwesterly wind." (Lyons.)

The "kona" or southerly gales, usually begin in November—rainy, damp, and blustering winds, at a higher temperature and with higher saturation than those just described. For the foreign residents they are often enervating and depressing, yet the saturation for the months of their prevalence is not materially higher than at other times. The first heavy snows on Mauna Kea and Mauna Loa came in early November, and occasionally cover a full half of the height of the mountain, extending as far downward as to the 7,000-foot level; the huge isolated dome of snow, rising in unobstructed splendor far above the tropic forests, is a spectacle of great sublimity. The top of Mauna Kea is almost exactly on the line of perpetual snow. The entire disappearance of the névé from the summits, as seen from below, is rare; and it is probable that the snow never entirely melts away. I have been on the summit of the mountain in July, and have seen large masses of frozen snow lying in the channels and wrinkles of the terminal cones, in spots where it could not be visible from the coast. But the question of its permanence could be settled only by establishing an observatory on the dome of the mountain; this could be built and maintained at no very great expense, and it would yield data of the highest value, especially in regard to the upper wind currents.

The cumulus clouds are the trade wind clouds; their lower limit in ordinary weather may be 2,800 feet; their upper limit, 8,000 feet. Above this air stream a ceaseless current flows from the northwest, bearing the cirrus clouds, in secular and uninterrupted march, at a height of from 10,000 to 25,000 feet. "During the eruptions of Mauna Loa the column of mineral smoke rises perpendicularly perhaps to 10,000 feet and then rolls away to the northeast" (Lyons).

Rainfall.—It will thus be seen that as to rainfall the islands have a great variety of climates. While some regions are almost rainless, others are deluged; and still others, like Honolulu, the chief place of resort, have a moderate rainfall only—the showers of an English April with the temperature of an Italian June.

* * * * * * *

The rapid discharge of the rainfall on the eastern coast of Hawaii is a sight to behold. I have stood upon the bank of a deep canon in the Hilo district, while the heavy rain-pour was deluging the slopes of Mauna Kea. Far below, a pure mountain stream, easily fordable by leaping from one lava rock to another, was foaming seaward. Presently the noise of unloosed waters came from the mountain side, growing momentarily louder, and soon the torrent, yellow and turbid, came thundering down the rocky valley, with no less force and fury than if a great dam had broken in the mountains; suddenly the little stream was magnified into a roaring and impassable torrent, a hundred times the volume of a few moments before. For days afterwards, and for miles around, the sea would be discolored by the turbid discharge, and the floating driftwood came ashore at distant points along the coast.

The accompanying maps of the individual islands, figs. 2 to 5 inclusive, show the location of the places mentioned in this article they also give the location and elevation of most of the stations for which data are published in the rainfall table furnished monthly by Mr. Lyons. A study of these tables in connection with the maps will prove most interesting. Mr. Lyons promises us a detailed study of the rainfall of the Honolulu district in the near future.—*H. H. K.*

ALASKAN METEOROLOGICAL DATA.

The following interesting climatological data regarding St. Michaels Bay were obtained from the records of the Alaskan Commercial Company by Dr. James T. White of the United States Revenue-Cutter Service.

Statement showing dates of final freezing and departure of the ice in St. Michaels Bay, of the coldest day, and of the first arrival of steamers from the Yukon and from outside in each year from 1874 to 1900.

Year.	Bay closed.	Coldest day.	Bay opened.	First arrival from sea.	First from Yukon River.
1874	Dec. 3	Jan. 1, —28°			
1875	Nov. 20	Feb. 15, —28	May 25		
1876	Nov. 6	Feb. 19, —46	June 8		
1877	Nov. 15	Feb. 7, —41	June 13	June 19	June 22
1878	Nov. 15	Feb. 17, —22	June 15	June 25	Sept. 21
1879	Nov. 9	Jan. 4, —36	June 9	June 22	Sept. 5
1880	Dec. 6	Dec. 17, —43	June 27	June 20	
1881	Dec. 7	Feb. 12, —35	June 11	June 14	June 19
1882	Nov. 25	Dec. 10, —24	June 9	June 24	June 17
1883	Nov. 21	Jan. 24, —35	June 8	June 22	June 10
1884	Oct. 10	Feb. 21, —43	June 10	June 7	June 17
1885	Nov. 5	Dec. 29, —33	June 30	June 24	Aug. 27
1886	Nov. 13	Jan. 20, —32	June 5	June 20	June 24
1887	Nov. 2	Jan. 30, —40	June 14	June 29	June 15
1888	Nov. 18	Nov. 28, —20	June 8	June 25	June 8
1889	Nov. 16	Mar. 8, —29	June 23	July 4	June 13
1890	Nov. 11	Jan. 26, —40	June 5	July 13	June 6
1891	Nov. 14	Jan. 30, —30	June 9	June 29	June 7
1892	Nov. 7	Jan. 21, —26	June 11	June 18	June 7
1893	Nov. 5	Feb. 4, —38	June 10	June 21	June 14
1894	Nov. 1	Jan. 14, —36	June 23	June 25	June 18
1895	Dec. 7	Feb. 15, —48	June 18	June 29	June 19
1896	Nov. 21	Mar. 23, —40	June 25	July 7	June 27
1897	Oct. 25	Feb. 19, —31	June 22	July 26	June 22
1898	Oct. 31	Mar. 1, —37	June 13	June 18	June 23
1899	Nov. 7	Jan. 21, —35	June 10	July 17	June 16
1900	Nov. 22		June 8	June 12	June 9
1901	Nov. 2	Jan. 13, —32 Jan. 29, —32	July 3		

Dr. White has also forwarded a copy of the meteorological observations made at St. Michaels under his direction, and other information of interest from July 1, 1900, to June 30, 1902, inclusive, and they will be published from time to time in the MONTHLY WEATHER REVIEW.—*H. H. K.*

CHARTING SIMULTANEOUS OBSERVATIONS.

The dates pertaining to the simultaneous observations at Greenwich noon are Greenwich dates and not local time dates. They do not change as the vessel moves from point to point, east or west. Vessels sailing eastward, or in the same direction as the earth's rotation, have local days that are longer than Greenwich days; those sailing westward have shorter local days. On the east going vessels crossing the Pacific there must be one local day on which there will be two Greenwich noon observations. On west going vessels there will be a local day so short that it will have no Greenwich noon observation. These days will be those on which the vessel crosses the one hundred and eightieth meridian.

Observers and students should bear in mind the following information:

In order to avoid confusion in charting meteorological data on the Pacific Ocean, it is necessary to keep in mind the rules adopted for fixing the dates, viz, the days of the week, the month, and the year. The residents of the islands in the Pacific keep their records on dates that accord with the usage of neighboring islands with which they are in commercial intercourse. On July 4, 1892, King Malietoa ordered that the American date, instead of the Australian date, should be kept throughout the Samoan Islands. Other islands had made similar changes at previous dates; thus, on December 31, 1844, the American date was abolished in the Philippine Islands and the European date adopted. At the present time the islands of the Pacific keep their dates as shown in the following list, which is taken from the Pilot Chart published September 1, 1899, by the United States Hydrographic Office:

American dates: Alaska, St. Lawrence Island, all the Aleutian Islands, Morell Island, Phœnix Islands, Samoan Islands.

Asiatic dates (one day later than the American dates): Siberia, Kamchatka, Copper Island, Marshall Islands, Gilbert Islands, Ellice Islands, Fiji Islands, Friendly Islands, New Zealand, Chatham Island.

When it is Saturday the first day of the month on the eastern or American side of this date line it is Sunday, or the second day of the month, on the western or Asiatic side, and this is true at any hour of the day or night.

In this connection the following instructions relative to simultaneous observations were lately issued by the United States Hydrographic Office:

In crossing the one hundred and eightieth meridian, observers aboard westward bound vessels sometimes make the mistake of dropping a day from the record of the Greenwich mean noon observations, and conversely of using the same date twice when eastward bound. This is incorrect. The observations in both cases should be dated consecutively, as a little consideration will show.

Take a case of a westward bound vessel making four degrees of longitude per day, and suppose her longitude at Greenwich mean noon of April 15 is 178° west. The local date and time of the observation is April 15, 0 h. 8 m. a. m. The local time of the next observation will be 23 h. 44 m. later than this, or (disregarding the change of date) April 15, 11 h. 52 m. p. m.; but advancing this date for the change from west to east longitude gives for the true local date and time of the observations April 16, 11 h. 52 m. p. m.

Again, let the vessel be eastward bound, and suppose her longitude at Greenwich mean noon of April 15 be 178° east. The local date and time of the observation is April 15, 11 h. 52 m. p. m. The local time of the next observation will be 24 h. 16 m. later than this, or (disregarding the change of date) April 17, 0 h. 8 m. a. m.; but setting back this date for the change from east to west longitude gives for the true local date and time of the observation April 16, 0 h. 8 m. a. m.

THE SEASON OF VEGETATION.

In the MONTHLY WEATHER REVIEW for February, 1901, page 55, Mr. Henry Pennywitt has given charts showing the natural division of the year into the colder and warmer half. In general, the warmer half is that portion of the year in which the average daily temperatures are above the normal average annual temperature. Presumably, all the growth of crops (except winter wheat) must take place within this warm season; in fact, for delicate vegetation, it must take place within a much shorter period, viz: the interval between the last frost of spring and the first of autumn. Tables and charts showing the average date of the last killing frost of spring and the first of autumn were published in Volume XVI MONTHLY WEATHER REVIEW, pages 51 and 165, respectively. The latest publication of this data as revised is to be found in the Year Book of the Department of Agriculture, 1897, page 618. According to thess charts, we should have for Fargo, N. Dak., near Moorhead, Minn., the dates May 15 for the latest spring frost and September 15 for the earliest autumn. A recent bulletin of the experiment station for North Dakota, which is located at Fargo, says:

The temperature which registers 26° F. has been taken as representing what is commonly known as killing frost. The following table gives the record of killing frosts during the past eight years at the experiment station at Fargo and the accompanying minimum temperature.

Year.	Last killing spring frosts.		First killing autumn frosts.		Interval between killing frosts.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		°F.		°F.	Days.
1894	April 15	21.5	Sept. 17	20	155
1895	May 21	20	Sept. 30	21	132
1896					
1897	June 7	26	Oct. 9	12	124
1898	May 11	21	Sept. 9	24	121
1899	May 14	23	Sept. 29	17	138
1900	May 9	25	Sept. 17	26	131
1901	April 22	25	Sept. 18	23	149
Average	May 10		Sept. 23		136

The following table gives similar data for the light frosts:

Year.	Last light spring frosts.		First light autumn frosts.		Interval between light frosts.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		°F.		°F.	Days.
1894	May 19	31	Sept. 11	29	115
1895	May 26	29	Aug. 31	30.5	97
1896					
1897	June 7	26	Sept. 17	20	102
1898	May 16	30	Sept. 8	27	115
1899	May 18	30	Sept. 18	9	118
1900	May 9	25	Sept. 17	26	131
1901	June 7	30	Sept. 18	23	103
Average	May 23		Sept. 12		111

From the above tables it will be seen that the interval between killing frosts has varied between one hundred and twenty-one and one hundred and fifteen days, while the interval between light frosts has varied between ninety-seven and one hundred and thirty-one days. The average date for the latest light frost is thirteen days later than the latest killing frost in the spring and eleven days earlier in the autumn. The relation of these dates to the maturing of the crops depends largely upon the plant under consideration. Thus, wheat that was sown sometime between April 14 and May 8 matured in from eighty-three to one hundred and twenty-three days during the eight years under consideration, the average being one hundred; that is to say, it was sown before the last killing frost of spring and matured from ten to thirty days before the first killing frost of autumn. Oats sown between April 8 and May 19 matured in from eighty to one hundred and fourteen days, depending, of course, upon the character of the summer, the average being ninety-five, and always before the dates of killing frosts. Barley sown between April 3 and May 21 matured in from seventy-one to one hundred and eleven days, the average being eighty-eight. Flax sown between May 3 and June 10 matured in from seventy-seven to one hundred and nine days, the average being eighty-nine. Millet sown between May 31 and June 8 matured in from sixty-six to one hundred and forty-two days, the average being ninety-six. Spelt sown between April 25 and May 10 matured in from eighty-six to ninety-six days, the average being ninety-two.

VOLCANIC DUST.

In accordance with the circular of May 27, 1902, Mr. M. B.

Stubbs, Observer United States Weather Bureau, Santo Domingo, reports:

While in the harbor of Monte Christo, Captain Garvin, of the Clyde Line, was told by the captain of the Norwegian bark, *Linnea*, that in running from Bahia, Brazil, for Barbados he got too far west and made St. Lucia. He then beat to the northward and on Sunday, May 11, was within 15 miles of Martinique, which, however, he could not see as it seemed surrounded by a cloud. No ashes were observed on this date. He arrived at Barbados on May 14, and early in the morning of that day 1½ inches of volcanic dust fell on the *Linnea's* deck.

THE VARIATION OF TERRESTRIAL GRAVITY OVER THE OCEAN.

As is well known, the study of the mechanics of the earth's atmosphere has usually been complicated by an effort to take account of the so-called viscosity of the air. In an article in the American Meteorological Journal for 1893, it has been shown that the irregular variations of gravity are of equal importance with viscosity. Meteorologists are therefore interested in every effort to determine the actual force of gravity, and in the MONTHLY WEATHER REVIEW for 1895, we have given the results of the work of the Coast and Geodetic Survey, so far as it relates to the surface of the United States. Up to the present time although the force of gravity has been measured on small islands in the ocean, yet nothing has been known as to its value at the surface of the ocean far from land. On this point our first knowledge is that given by F. R. Helmert, Director of the Royal Geodetic Institution at Berlin. In his annual report for April, 1902, he says:

The measurements of relative gravity on the ocean, as planned by myself, following Mohn's method of comparison of mercurial barometers and boiling point thermometers, has been carried out after thorough preparatory work by Dr. Hecker, along the line Hamburg-Lisbon-Rio Janeiro-Lisbon, with the assistance of the Committee on International Geodesy and the allowance of free passage on the part of the Hamburg-South American Steamship Association in the months July-October, 1901. Although the mean error of observation for a complete series (which consists of many determinations with four barometers and six thermometers during a morning or an afternoon) is much larger than the corresponding error in the case of pendulum observations, namely, about plus or minus 0.028 centimeters per second in the value of the acceleration of gravity, still it was established that on the deep ocean the acceleration of gravity certainly differs only a very few hundredths of a centimeter from that in the shallow sea near the coast, being perhaps 0.032 centimeters smaller. It can therefore no longer be maintained that the large value of g observed on the small oceanic islands extends over the ocean itself, and as little can the reverse be maintained, namely, that the apparent defect of mass, in the space occupied by the sea makes itself felt by a great diminution of g relative to that on land.

In connection with the results of Nansen's polar expedition, in the northern Polar Sea, Hecker's determinations add to the probability of the general truth of the equilibrium theory of the earth's crust, as explained by Pratt. Further details are given in the Sitzungsberichte of the Berlin Academy, February, 1902, as also in the report of the work of the Central Bureau of International Geodesy for 1901. As to the accuracy of the new boiling point thermometer, see the Zeitschrift für Instrumentenkunde, 1901, p. 133.—*C. A.*

A METEOROLOGICAL LIBRARY.

If any observer wishes to acquire a very complete library of about 2,000 volumes and 3,000 pamphlets, mostly on meteorology and magnetism, he will do well to address "Madame R. von Wild, Englisch viertel No. 56, Zurich, Switzerland."

CORRIGENDA.

In the MONTHLY WEATHER REVIEW for June, 1902, page 309, column 1, make lines 11 and 12 read as follows:

$$v\varpi = -\frac{c}{2}\varpi^2 z = 2g\frac{\varpi z}{v} = \varpi u z = -\frac{\varpi^2 w}{2} = \text{constant},$$

by 307 and 308, introducing the value $v^2 = 2gz$.

In line 13, dele "not."

Make lines 15 and 16 read as follows:

492. Case I. $$v\varpi = -\frac{\lambda}{k-c}\frac{c}{2}\varpi^2 z = \text{const.}$$

Case II. $$v\varpi = -\frac{\lambda}{k}cz = \text{const.}$$

In line 20, change "these" to "the."

Make line 21 read "values in equation 490."

In line 22 insert "Case I" after "493" and between lines 22 and 23 insert the following:

Case II. $$\frac{\partial u}{\partial \varpi} + \frac{u}{\varpi} + \frac{\partial w}{\partial z} = +\frac{c}{\varpi^2} - \frac{c}{\varpi^2} + 0 = 0.$$

Page 307, make equation 519 read as follows:

519. $$-\frac{1}{\rho}\frac{\partial p}{\partial x} = -\frac{1}{\rho}\sigma_m\frac{\partial B}{\partial x} = -\frac{1}{\rho}\frac{\sigma_m}{111\ 111}G = -\frac{0.12237G}{\rho}.$$

(G is in meters.)

THE WEATHER OF THE MONTH.

By W. B. STOCKMAN, Forecast Official, in charge of Division of Records and Meteorological Data.

CHARACTERISTICS OF THE WEATHER FOR JULY.

The cloudiness was everywhere above the average (decidedly so in the southern slope region) except in the South Atlantic States, Ohio Valley and Tennessee, lower Lake region, the southern Plateau region, North Dakota, Missouri Valley, and the middle Pacific coast region, in which districts the departures ranged from —0.2 to —0.7. The relative humidity was normal in North Dakota; below, from 3 per cent to 7 per cent, in the South Atlantic and east Gulf States, the Florida Peninsula, and the southern Plateau and north Pacific and middle Pacific regions; elsewhere it was above the normal, in values ranging from 1 per cent to 9 per cent. The precipitation was normal in the middle Pacific coast region; below in the Atlantic and east Gulf States, Florida Peninsula, North Dakota, the middle slope, and southern Plateau regions, with departures ranging from —0.3 inch to —3.00 inches; elsewhere it was above the mean, with values ranging from +0.1 inch to +2.3 inches. The temperature was above the normal, in daily values of from +0.1° to +1.6° in the Middle Atlantic, South Atlantic and east Gulf States, Florida Peninsula, Tennessee and the Ohio Valley, Lake region, upper Mississippi Valley, and the middle Pacific region; elsewhere it was below, decidedly so in New England and the Plateau and middle slope regions, where the daily departures amounted to from —2.1° to —3.7°. Strong winds were infrequent but where they occurred, as a rule, the velocities were unusually high.

PRESSURE.

The distribution of monthly mean pressure is shown graphically on Chart IV and the numerical values are given in Tables I and VI.

The area inclosed within the isobar of 30.00 inches of monthly mean pressure included the Middle Atlantic, South Atlantic, east Gulf, and eastern part of the west Gulf States, the central Mississippi and Ohio valleys and the lower Lake region; also the western parts of Washington and Oregon and northwestern California. The highest monthly mean pressures reported were but slightly above 30.05 inches, and occurred

from West Virginia and eastern Kentucky southward over Florida; and also in southwestern Washington and northwestern California. The lowest monthly mean pressures were reported from the southern Plateau region, where the mean for the month was below 29.80 inches. The monthly mean pressure was slightly above the normal from Texas eastward over Florida and northeastward over the lower Lakes and New England, the greatest departures from the normal being +.06 inch; the pressure was also slightly above the normal from eastern Oregon and southwestern Idaho southward over southern California; elsewhere the mean monthly pressure was below the normal, the departures, however, not being very marked except in the Dakotas and eastern Montana, where they ranged from —.05 inch to —.09 inch. From eastern South Dakota and western Minnesota northwestward over northeastern Washington the pressure diminished slightly from June, 1902; elsewhere the pressure increased, and over the greater part of the country to a marked degree, especially over the Southern States, where the changes generally exceeded .10 inch.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

The mean temperature for the month was above the normal on the central and northern coasts of California, in northern Minnesota, eastern North Dakota, northeastern South Dakota, Missouri, Arkansas, western Mississippi, eastern Louisiana, and the lower Rio Grande Valley, and, excepting in New York State near Lake Ontario and the extreme southern part of Florida, over the entire region between the seventy-fifth and ninetieth meridians of longitude. The greatest daily excesses ranged from +2° to +4° and occurred in northeastern Michigan, northern and western North Carolina, southeastern Tennessee, and eastern Alabama; elsewhere it was below the normal, and generally the deficiencies were quite marked, in the territory embraced by the one hundred and fifth and one hundred and twentieth meridians ranging from —2° to more than —4°. The isotherm of 80° of mean temperature passes westward along the thirty-sixth parallel, and southward along the one hundred and first meridian, and its trend is far to the southward and considerably to the eastward of its position in July, 1901. The trend westward of the isotherm of 70° of mean temperature was about the same as during July, 1901, but its southerly trend lay somewhat to the eastward, and west of the one hundredth meridian, considerably to the southward of its position for July, 1901. The region of maximum temperatures of 100°, or slightly higher, embraced the South Atlantic and east Gulf States, generally, western Tennessee, the lower Ohio Valley, portions of Texas, Indian Territory, New Mexico, the northern and southern Plateau, and the interior of the Pacific regions, whereas in July, 1901, it comprised practically the entire United States. Maximum temperatures of 110° or higher occurred in western Arizona and the interior of California, in the latter extending much farther to the northward than in 1901. East of the ninety-fifth meridian, and in Kansas, Oklahoma, Indian Territory, and Texas the mean minimum temperatures were about the same as during July, 1901, but over the remaining districts they were lower. Temperatures of 32°, or lower, occurred at elevated points in the mountain districts only.

In Canada—Prof. R. F. Stupart says:

The temperature was about average in Manitoba and in Ontario east as far as the Muskoka district, and south to Lake Ontario, including all the peninsula excepting the north shores on Lake Erie. The greatest plus departures, amounting to from 3° to 4°, occurred over the Strait of Mackinac and in the Georgian Bay region. Elsewhere in Canada the temperature varied from average to 4° below, the chief negative departures being reported in northern British Columbia and in Assiniboia.

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	65.7	−2.1	+ 4.0	+0.6
Middle Atlantic	12	74.9	+0.2	− 2.5	−0.4
South Atlantic	10	81.5	+1.6	− 6.7	−1.0
Florida Peninsula	8	82.2	+0.8	− 4.2	−0.6
East Gulf	9	82.4	+1.4	− 2.7	−0.4
West Gulf	7	81.3	−0.5	+ 2.4	+0.3
Ohio Valley and Tennessee	11	77.8	+0.9	− 6.0	−0.9
Lower Lake	8	71.6	+0.4	− 0.4	−0.1
Upper Lake	10	68.7	+1.4	+13.1	+1.9
North Dakota	8	68.0	−0.2	+16.5	+2.4
Upper Mississippi Valley	11	75.2	+0.2	+ 4.5	+0.6
Missouri Valley	11	74.7	−0.4	+ 8.3	+1.2
Northern Slope	7	67.0	−2.4	+10.4	+1.5
Middle Slope	6	75.4	−0.9	+ 7.3	+1.0
Southern Slope	6	78.7	−1.0	+ 6.6	+0.9
Southern Plateau	13	74.7	−3.3	− 1.6	−0.2
Middle Plateau	9	67.8	−3.7	+ 2.8	+0.4
Northern Plateau	12	65.0	−3.3	+ 3.2	+0.5
North Pacific	7	61.3	−0.7	+ 1.7	+0.2
Middle Pacific	5	64.4	+0.1	− 2.0	−0.3
South Pacific	4	69.5	−1.1	− 2.5	−0.4

PRECIPITATION.

Excessively heavy monthly rains, in amounts from 10 to 16 inches, and departing from the normal from +4.00 to +7.50 inches, occurred over portions of southwestern New York, Texas, southwestern Arkansas, eastern Nebraska, and southwestern Iowa. The precipitation was also above the normal on the Georgia and northeastern Florida and Pacific coasts, in southern Arkansas, northern Louisiana, the western parts of the Plateau regions, western North Dakota, and from central New York and the Lower Peninsula of Michigan westward to eastern Colorado and Wyoming. Along the lake shore of Pennsylvania and western Ohio and in southeastern Michigan the departures ranged from +2.2 to +4.2. In the remaining districts the precipitation was below the normal, the greatest departures occurring in the South Atlantic and east Gulf States, the Ohio Valley and Tennessee, and northern Arkansas, where the deficiencies generally amounted to from 2 to 4 inches.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	2.45	69	−1.1	−0.9
Middle Atlantic	12	3.21	74	−1.1	−2.7
South Atlantic	10	4.54	74	−1.6	−9.0
Florida Peninsula	8	6.20	95	−0.3	−1.4
East Gulf	9	2.92	49	−3.0	−10.0
West Gulf	7	4.77	155	+1.7	−4.6
Ohio Valley and Tennessee	11	2.57	62	−1.6	−6.6
Lower Lake	8	5.43	173	+2.3	+1.3
Upper Lake	10	4.16	136	+1.1	−0.8
North Dakota	8	1.93	83	−0.4	+1.1
Upper Mississippi Valley	11	4.40	116	+0.6	−0.1
Missouri Valley	11	5.34	143	+1.6	−0.7
Northern Slope	7	1.97	118	+0.3	+0.5
Middle Slope	6	2.71	93	−0.2	+1.4
Southern Slope	6	3.61	120	+0.6	+2.0
Southern Plateau	13	1.08	73	−0.4	−1.8
Middle Plateau	8	0.61	120	+0.1	−1.0
Northern Plateau	12	1.42	229	+0.8	−0.2
North Pacific	7	1.65	174	+0.7	+3.4
Middle Pacific	5	0.05	100	0.0	+1.5
South Pacific	4	0.23	767	+0.2	−0.4

In Canada.—Professor Stupart says:

In all parts of Ontario east of Lake Superior the rainfall was largely above the average amount, especially from the Georgian Bay south to Lake Erie, where in nearly all localities the average was exceeded by

from 3 to 5 inches and over. East of Lake Ontario some excessive plus departures were also recorded, noticeably Peterboro 5.9 inches and Port Hope 5.7 inches. Alberta rainfall was also generally above the average, ranging from 0.2 of an inch in the northern portion to over 2 inches in the southern portion. The rainfall at Calgary of 5 inches, making in all for the three months of May, June, and July no less than 23.7 inches, is a phenomenal amount when it is considered that the everage mean annual precipitation for this station is only 15 inches; elsewhere throughout Canada the rainfall was below the average, but in British Columbia, Quebec, and in the greater part of Assiniboia and Saskatchewan to a small extent only. In Manitoba it was from 1 to nearly 2 inches below, and in the Maritime Provinces it was from 1.5 to nearly 3 inches less than the average, several districts in the latter provinces complaining of damage owing to drought.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 4, 14, 15. Arizona, 10, 13. California, 3, 4, 9. Colorado, 4, 5, 6, 9, 11, 12, 13, 17, 18, 19, 21, 25, 26, 27, 30, 31. Connecticut, 14, 15, 17, 21, 28. Delaware, 15, 21. Florida, 8, 12, 13, 20. Georgia, 4, 7, 20, 24. Idaho, 17. Illinois, 8, 14, 16, 17, 18, 22, 24, 28, 31. Indiana, 2, 23, 26. Iowa, 6, 9, 11, 14, 16, 17, 18, 19, 25, 26, 30. Kansas, 1, 4, 5, 6, 7, 17, 20, 21, 22, 26, 28. Kentucky, 4, 15, 30. Louisiana, 15, 21. Maine, 15. Maryland, 6, 15, 18, 20, 25, 27. Massachusetts, 15, 16, 17. Michigan, 2, 7, 8, 10, 15, 16, 17, 19, 20, 24, 26. Minnesota, 4, 5, 7, 11, 12, 16, 22, 23, 24, 25, 29, 30. Mississippi, 14, 26, 29. Missouri, 7, 9, 14, 17, 18, 22, 24, 25, 31. Montana, 3, 12, 17, 27. Nebraska, 4, 5, 6, 7, 12, 13, 14, 17, 19, 24, 25, 26, 29, 30. Nevada, 1, 2, 3, 5, 24, 26. New Hampshire, 14, 15. New Jersey, 5, 15, 16, 18, 22, 24, 25. New Mexico, 10, 17, 19, 20. New York, 5, 6, 7, 14, 15, 17, 21, 22, 23, 24, 27, 28. North Carolina, 4, 5, 7, 10, 18, 20, 21. North Dakota, 6, 13, 16, 19, 23, 24, 25, 28, 29. Ohio, 2, 6, 9, 18 19, 24, 27, 28. Oregon, 30. Pennsylvania, 3, 4, 5, 12, 15, 17, 18, 19, 21, 24, 25, 26, 28. South Carolina, 3, 7, 11, 20, 21. South Dakota, 4, 5, 6, 7, 10, 11, 12, 13, 23, 30. Tennessee, 5, 9. Utah, 3, 17, 26. Vermont, 14, 21. Virginia, 7, 10, 19, 20, 26. Washington, 1. West Virginia, 6, 7. Wisconsin, 14, 16, 22, 23, 24, 25, 26, 27, 29, 30. Wyoming, 1, 2, 4, 6, 8, 13, 18, 19, 22, 25, 26.

SLEET.

The following are the dates on which sleet fell in the respective States:

Colorado, 5. Minnesota, 24. Montana, 7, 17.

HUMIDITY.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	80	+ 1	Missouri Valley	70	+ 3
Middle Atlantic	75	+ 3	Northern Slope	58	+ 6
South Atlantic	75	− 5	Middle Slope	63	+ 2
Florida Peninsula	77	− 3	Southern Slope	67	+ 9
East Gulf	72	− 7	Southern Plateau	37	− 5
West Gulf	76	+ 3	Middle Plateau	33	+ 1
Ohio Valley and Tennessee	70	+ 1	Northern Plateau	47	+ 4
Lower Lake	76	+ 8	North Pacific	70	− 7
Upper Lake	76	+ 5	Middle Pacific	60	− 7
North Dakota	66	0	South Pacific	66	+ 3
Upper Mississippi Valley	73	+ 5			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Baltimore, Md.	29	70	w.	Mount Tamalpais, Cal.	26	54	sw.
Chicago, Ill.	17	69	sw.	Do.	31	61	nw.
Independence, Cal.	2	52	nw.	New York, N. Y.	15	52	w.
Lincoln, Nebr.	13	50	n.	Point Reyes Light, Cal.	1	85	nw.
Macon, Ga.	11	55	s.	Do.	2	90	nw.
Modena, Utah	2	58	s.	Do.	3	68	nw.
Mount Tamalpais, Cal.	1	54	nw.	Do.	4	62	nw.
Do.	2	69	nw.	Do.	5	70	nw.
Do.	3	56	nw.	Do.	6	62	nw.
Do.	11	55	nw.	Do.	15	56	nw.
Do.	15	55	nw.	Port Huron, Mich.	27	60	sw.
Do.	25	67	sw.	Spokane, Wash.	15	52	w.

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.8	+ 0.9	Missouri Valley	4.2	− 0.2
Middle Atlantic	5.4	+ 0.6	Northern Slope	4.9	+ 0.2
South Atlantic	4.3	− 0.7	Middle Slope	4.2	+ 0.2
Florida Peninsula	5.1	+ 0.1	Southern Slope	6.0	+ 2.2
East Gulf	5.4	+ 0.4	Southern Plateau	2.6	− 0.7
West Gulf	5.1	+ 0.9	Middle Plateau	2.9	+ 0.9
Ohio Valley and Tennessee	4.3	− 0.3	Northern Plateau	3.3	+ 0.2
Lower Lake	3.8	− 0.7	North Pacific	4.6	+ 0.2
Upper Lake	5.6	+ 0.9	Middle Pacific	2.5	− 0.4
North Dakota	3.6	− 0.7	South Pacific	3.2	+ 0.5
Upper Mississippi Valley	4.8	+ 0.5			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 8,265 thunderstorms were received during the current month as against 7,732 in 1901 and 6,406 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 18th, 412; 20th, 377; 19th, 369.

Reports were most numerous from: Ohio, 462; New York, 440; Nebraska, 438.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 16th to 24th.

In Canada: Thunderstorms were reported as follows: St. John, N. B., 8, 18; Halifax, 9; Grand Manan, 23; Yarmouth, 16, 17, 18, 22, 23; Chatham, 8; Father Point, 8, 13; Quebec, 1, 3, 8, 13, 14, 15, 17, 24, 28, 31; Montreal, 7, 8, 15, 17, 31; Bissett, 13, 14, 15, Ottawa, 15, 17; Kingston, 7, 14, 15; Toronto, 4, 5, 7, 9, 14, 17, 21, 23, 26, 27; White River, 5, 8, 13, 15, 17, 21, 26, 31; Port Stanley, 3, 4, 5, 7, 8, 9, 14, 15, 17, 20, 21, 24, 26; Parry Sound, 7, 15, 26, 31; Port Arthur, 7, 16, 30; Winnipeg, 4, 5, 7; Minnedosa, 2, 4, 5, 6, 13, 14, 19, 29; Qu'Appelle, 3, 13, 15, 23; Medicine Hat, 15; Swift Current, 3, 11, 18, 24, 31; Calgary, 11, 27, 30; Banff, 11, 15, 17, 21, 26, 28, 31; Edmonton, 11, 12, 15; Prince Albert, 11, 13, 22; Battleford, 12, 17, 23, 27, 31; Kamloops, 15; Victoria, 30; Hamilton, Bermuda, 14, 16, 26, 27, 28. No auroras reported from Canada in July, 1902.

DESCRIPTION OF TABLES AND CHARTS.

By W. B. STOCKMAN, Forecast Official, in charge of Divison of Records and Meteorological Data.

Table I gives, for about 145 Weather Bureau stations making two observations daily and for about 25 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station, the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table IV gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table V gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates per hour (ins.)	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table VI gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table VII gives the heights of rivers referred to zeros of gages; it is prepared by the Forecast Division.

NOTES EXPLANATORY OF THE CHARTS.

Chart I, tracks of centers of high areas, and Chart II, tracks of centers of low areas, are constructed in the same way. The roman numerals show number and chronological order of highs (Chart I) and lows (Chart II). The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the observations at 8 a. m. and 8 p. m., seventy-fifth meridian time. Within each circle is also given (Chart I) the highest barometric reading and (Chart II) the lowest barometric reading at or near the center at that time, and in both cases as reduced to sea level and standard gravity.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all by 0.0.

Chart IV.—Sea-level pressure and resultant surface winds. The pressures have been reduced to sea level and standard gravity by the method fully described by Prof. Frank H. Bigelow on pages 13–16 of the REVIEW for January, 1902. The pressures have also been further reduced to the mean of the twenty-four hours by the application of a suitable correction, to the mean of the 8 a. m. and 8 p. m. readings, at stations taking two observations daily, and to the 8 a. m. or 8 p. m. observation, respectively, at stations taking but a single observation. The diurnal corrections so applied will be found in Table 27, Volume II, Annual Report of the Chief of Weather Bureau, 1900–1901, pp. 140–164. The publication of isotherms for sea level will be resumed at some future time.

The wind directions are the computed resultants of observations at 8 a. m. and 8 p. m. daily. The resultant duration is shown by figures attached to each arrow.

Chart V.—Hydrographs for seven principal rivers of the United States, prepared by the Forecast Division.

Chart VI.—Surface temperatures; maximum, minimum, and mean of these. Lines of equal monthly mean temperature in red; lines of equal maximum temperature in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

Chart VIII.—West Indian monthly isobars, isotherms, and resultant winds.

TABLE I.—*Climatological data for Weather Bureau Stations, July, 1902.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
New England.							**65.7**	**— 2.1**											**80**	**2.45**	**— 1.1**									**5.8**	
Eastport	76	69	74	29.87	29.95	+ .02	60.8	+ 0.4	82	29	69	48	2	52	30	56	53	80	1.05	— 2.8	11	4,770	sw.	24	nw.	11	9	13	9	5.3	
Portland, Me	103	81	117	29.85	29.97	+ .02	65.4	— 3.1	90	9	73	51	2	58	30	60	56	75	2.21	— 1.4	7	5,603	sw.	28	s.	15	9	14	8	5.0	
Northfield	876	15	65	29.05	29.99	+ .05	63.6	— 1.5	88	8	74	42	17	54	34	60	57	77	2.91	— 0.8	12	5,731	s.	34	nw.	15	2	14	15	7.1	
Boston	125	115	181	29.86	29.99	+ .03	67.8	— 3.5	91	14	75	52	7	61	25	62	59	75	2.88	— 0.6	14	6,544	e.	39	w.	15	7	9	15	6.5	
Nantucket	12	43	85	29.98	29.99	+ .01	64.9	— 2.3	78	18	70	52	7	60	18	62	60	87	1.76	— 0.7	9	8,315	sw.	35	nw.	15	5	14	12	6.3	
Block Island	26	11	60	29.98	30.00	+ .03	66.1	— 2.3	80	18	71	54	17	61	19	63	61	88	2.31	— 0.9	13	.....	sw.	.....	.....	.....	10	14	7	4.9	
Narragansett	.....	10	.....	.....	.....	.....	67.4	— 2.8	88	9	75	49	17	60	26	.....	.....	.....	3.25	+ 0.1	14	.....	sw.	.....	.....	.....	14	7	10	.....	
New Haven	106	117	140	29.88	29.99	+ .02	69.8	— 2.0	90	9	78	53	17	62	26	64	61	77	3.26	— 1.7	17	5,346	sw.	27	n.	22	11	7	13	5.6	
Mid. Atlantic States.							**74.9**	**+ 0.3**											**75**	**3.21**	**— 1.1**									**5.4**	
Albany	97	102	115	29.88	29.98	+ .02	70.4	— 2.0	92	9	79	53	17	62	28	64	61	76	5.37	+ 1.4	15	4,924	s.	32	nw.	15	5	10	16	7.0	
Binghamton	875	79	90	29.07	29.98	+ .01	69.2	+ 0.5	87	14	79	50	17	60	36	.....	.....	.....	5.51	+ 2.3	14	3,496	w.	25	sw.	3	3	17	11	6.4	
New York	314	108	350	29.67	29.99	+ .01	73.6	+ 0.1	91	9	81	61	11	66	25	66	62	73	3.12	— 1.1	14	7,996	nw.	52	w.	15	6	8	17	6.8	
Harrisburg	374	94	104	29.62	30.01	+ .03	74.3	+ 1.4	95	17	83	57	25	65	35	.....	.....	.....	3.68	— 0.6	14	3,881	w.	36	nw.	24	8	10	13	6.2	
Philadelphia	117	168	184	29.89	30.01	+ .03	75.6	— 0.1	95	9	84	60	11	67	24	68	64	71	3.51	— 0.7	13	7,229	sw.	29	sw.	17	8	10	13	5.9	
Scranton	805	111	119	29.16	30.01	+ .03	71.0	.....	90	9	81	50	2	61	37	64	61	75	4.60	.....	16	4,477	sw.	32	sw.	24	5	12	14	6.8	
Atlantic City	52	39	48	29.96	30.01	+ .03	72.1	+ 0.2	94	5	78	59	2	66	28	68	66	87	2.83	— 0.6	12	5,582	sw.	26	sw.	15	11	20	0	4.2	
Cape May	17	47	51	30.02	30.03	+ .05	72.2	— 1.4	92	20	78	61	1	66	25	67	.....	.....	1.94	— 1.4	11	5,011	s.	28	se.	25	12	16	3	4.5	
Baltimore	123	68	82	29.87	29.99	+ .01	77.8	+ 0.6	99	18	87	62	23	69	30	70	67	74	2.45	— 2.2	15	5,098	sw.	70	w.	20	6	13	12	6.2	
Washington	112	59	76	29.90	30.01	+ .01	77.0	+ 0.2	99	18	87	57	12	67	38	69	65	71	2.54	— 2.0	11	4,303	s.	34	n.	6	11	17	3	4.8	
Cape Henry	.....	5	58	30.02	30.03	+ .05	78.1	+ 1.1	101	20	86	64	1	70	29	.....	.....	.....	2.22	— 3.4	9	7,751	sw.	45	nw.	15	11	17	3	4.6	
Lynchburg	681	83	88	29.30	30.03	+ .02	78.5	+ 1.0	99	17	90	58	17	67	41	69	64	67	1.66	— 2.2	8	2,955	sw.	24	nw.	19	11	18	2	4.2	
Norfolk	91	102	111	29.94	30.03	+ .03	79.6	+ 1.1	98	10	88	65	12	71	28	72	69	76	3.74	— 2.2	7	6,148	s.	28	n.	15	18	11	2	3.4	
Richmond	144	82	90	29.88	30.03	+ .02	79.0	.....	98	19	90	62	3	68	35	.....	.....	.....	6.21	.....	13	3,837	s.	28	nw.	6	8	16	7	5.1	
S. Atlantic States.							**81.5**	**+ 1.6**											**75**	**4.54**	**— 1.6**									**4.3**	
Charlotte	773	68	76	29.24	30.05	+ .03	80.2	+ 2.0	98	5	90	63	25	70	25	70	67	71	4.58	— 1.0	10	3,999	ne.	29	w.	20	14	10	7	4.4	
Hatteras	11	12	47	30.04	30.05	+ .04	79.7	+ 1.8	92	5	84	70	*	75	14	74	71	80	2.59	— 3.8	6	8,784	sw.	30	s.	22	15	12	4	4.1	
Kittyhawk	8	12	30	.....	.....	.....	80.0	+ 2.0	96	18	86	68	*	74	22	.....	.....	.....	4.28	— 1.6	6	8,470	sw.	.....	.....	.....	25	5	1	2.3	
Raleigh	376	93	101	29.64	30.02	.00	80.7	+ 3.6	101	19	91	64	23	70	29	71	67	70	3.39	— 1.6	11	4,053	sw.	25	nw.	29	12	9	10	5.0	
Wilmington	78	82	90	29.94	30.02	+ .01	80.5	+ 0.8	100	5	88	65	12	72	24	73	71	78	2.98	— 4.3	9	5,343	sw.	29	se.	15	14	11	6	4.5	
Charleston	48	14	92	30.01	30.05	+ .02	82.8	+ 1.0	103	6	89	70	24	76	25	75	73	77	6.79	— 0.8	12	7,359	sw.	43	n.	4	8	20	3	4.7	
Columbia	351	114	122	29.68	30.03	+ .03	82.3	+ 1.7	101	4	92	65	25	72	29	72	68	70	2.78	— 2.8	10	5,195	sw.	26	sw.	20	11	14	6	4.7	
Augusta	180	89	97	29.85	30.03	+ .01	82.6	+ 1.5	102	6	93	64	24	73	29	73	69	69	2.00	— 3.3	12	3,941	s.	32	ne.	24	12	16	3	4.2	
Savannah	65	79	89	29.99	30.05	+ .02	82.8	+ 0.9	101	6	92	70	13	74	27	76	74	83	9.28	+ 3.5	11	5,116	sw.	39	n.	13	12	17	2	4.2	
Jacksonville	43	101	129	30.00	30.05	+ .02	83.0	+ 0.9	101	7	92	69	13	74	26	74	72	76	6.69	+ 0.2	16	4,981	sw.	36	s.	21	10	16	5	4.6	
Florida Peninsula.							**82.1**	**+ 0.1**											**77**	**4.65**	**— 1.1**									**5.1**	
Jupiter	28	10	30	30.04	30.07	+ .04	81.6	+ 0.8	90	19	88	70	26	75	19	76	74	80	4.73	— 0.5	11	5,987	se.	34	sw.	26	7	18	6	5.0	
Key West	22	43	50	30.02	30.03	.00	83.2	— 0.7	89	27	87	71	3	79	16	76	73	72	1.57	— 2.3	8	5,254	e.	24	ne.	14	13	15	3	4.1	
Tampa	34	60	67	30.03	30.06	+ .02	81.5	+ 0.1	96	8	90	68	13	73	24	74	72	78	7.64	— 0.6	14	4,008	se.	36	s.	20	5	18	8	6.1	
East Gulf States.							**82.4**	**+ 1.4**											**72**	**2.92**	**— 3.0**									**5.4**	
Atlanta	1,174	190	216	28.85	30.06	+ .04	80.3	+ 1.9	98	2	90	62	22	70	28	69	65	68	2.83	— 2.1	11	6,801	nw.	36	n.	8	5	19	7	5.9	
Macon	370	93	99	29.67	30.07	+ .05	81.4	.....	101	1	92	64	11	71	30	.....	.....	.....	5.15	.....	11	3,514	s.	55	s.	11	11	10	10	5.3	
Pensacola	56	78	96	30.01	30.07	+ .06	82.0	+ 1.2	92	7	88	71	21	76	18	.....	.....	.....	2.01	— 4.7	11	5,956	n.	40	e.	8	10	17	4	4.9	
Mobile	57	88	96	30.00	30.06	+ .05	81.9	+ 0.7	96	7	90	70	20	74	22	74	72	76	2.65	— 3.9	15	4,462	nw.	40	se.	8	15	9	7	4.5	
Montgomery	223	100	112	29.81	30.03	+ .01	84.0	+ 2.5	101	7	94	68	23	74	27	72	67	64	0.43	— 4.1	7	4,413	sw.	28	sw.	28	10	14	7	5.0	
Meridian	375	84	93	29.66	30.04	+ .02	81.8	+ 1.8	102	8	93	64	23	70	32	.....	.....	.....	3.10	— 2.3	9	3,182	sw.	28	sw.	29	10	14	7	5.1	
Vicksburg	247	62	74	29.76	30.02	+ .04	81.4	+ 0.1	96	7	90	67	22	72	24	73	70	77	6.68	+ 2.2	13	4,116	s.	36	nw.	10	4	20	7	5.3	
New Orleans	51	88	121	29.99	30.04	+ .04	83.0	+ 0.8	95	13	91	69	15	75	22	75	72	76	4.24	— 2.2	10	4,471	s.	41	sw.	15	1	12	18	7.1	
Port Eads	.....	27	.....	.....	.....	.....	84.7	+ 2.4	95	7	92	70	27	78	18	.....	.....	.....	1.38	— 6.9	9	.....	se.	.....	.....	.....	1	20	10	.....	
West Gulf States.							**81.3**	**— 0.5**											**76**	**4.77**	**+ 1.7**									**5.1**	
Shreveport	249	77	84	29.77	30.02	+ .04	80.8	— 1.7	95	10	89	68	22	72	22	74	72	82	8.02	+ 4.5	13	4,287	se.	25	se.	29	9	14	8	5.5	
Fort Smith	457	79	94	29.51	29.98	+ .01	80.4	+ 0.4	97	15	90	63	21	71	27	71	68	71	0.70	— 3.7	9	5,644	e.	28	s.	3	3	27	1	5.1	
Little Rock	357	93	100	29.65	30.02	+ .03	80.4	+ 0.1	96	16	89	64	22	72	23	71	68	70	7.46	+ 3.4	5	4,747	s.	25	s.	29	12	15	4	4.2	
Corpus Christi	20	48	53	29.96	29.98	+ .02	82.7	+ 1.0	90	11	87	76	16	78	13	77	75	80	0.49	— 0.8	7	10,178	se.	27	se.	27	10	19	2	4.4	
Fort Worth	670	106	114	29.29	29.99	+ .03	81.6	.....	98	11	90	68	25	73	26	.....	.....	.....	6.29	.....	12	8,614	s.	48	s.	3	11	17	3	4.3	
Galveston	54	106	112	29.94	30.00	+ .02	82.3	— 1.6	91	11	86	71	27	78	14	76	73	76	2.81	— 0.3	10	8,383	se.	28	se.	7	11	15	5	4.6	
Palestine	510	73	79	29.49	30.02	+ .05	79.8	— 1.7	94	19	88	67	12	71	23	72	70	80	10.03	+ 7.4	17	5,095	se.	25	sw.	28	2	19	10	6.6	
San Antonio	701	80	91	29.24	29.95	.00	83.0	— 0.3	97	17	93	69	29	73	25	74	70	73	3.85	+ 1.6	14	6,007	se.	25	n.	21	6	18	7	5.5	
Taylor	583	55	63	29.38	29.98	+ .02	81.7	.....	96	20	91	68	29	72	24	.....	.....	.....	7.98	.....	14	7,472	s.	38	e.	20	8	14	9	5.4	
Ohio Val. and Tenn.							**77.8**	**+ 0.9**											**70**	**2.57**	**— 1.6**									**4.3**	
Chattanooga	762	106	112	29.27	30.07	+ .05	80.6	+ 2.8	98	17	92	60	23	70	30	69	64	64	0.67	— 3.6	11	4,435	ne.	43	w.	2	4	20	7	5.5	
Knoxville	1,004	10	88	29.02	30.06	+ .04	78.1	+ 1.7	98	9	89	57	22	67	28	70	67	74	3.73	— 0.6	6	3,835	n.	42	nw.	10	14	14	3	4.2	
Memphis	397	140	154	29.62	30.04	+ .04	81.1	+ 0.4	96	16	89	65	22	73	22	75	73	78	1.10	— 2.4	2	5,540	sw.	28	ne.	31	16	10	5	4.1	
Nashville	546	122	131	29.48	30.06	+ .05	80.8	+ 1.5	101	17	92	60	22	70	30	69	63	61	1.89	— 2.4	8	3,993	sw.	33	nw.	28	18	9	4	3.7	
Lexington	989	75	102	29.02	30.06	+ .05	76.8	+ 1.1	96	17	86	58	22	67	28	.....	.....	.....	2.33	— 2.8	7	5,220	sw.	38	w.	19	14	17	0	3.6	
Louisville	525	114	136	29.48	30.06	+ .06	79.2	+ 0.8	98	17	90	59	22	69	29	69	65	64	1.87	— 1.9	8	4,419	sw.	38	w.	8	15	11	5	3.6	
Evansville	431	72	82	29.56	30.02	+ .02	79.5	.....	98	17	89	60	1	70	27	.....	.....	.....	0.41	.....	7	4,369	s.	32	ne.	16	13	17	1	3.7	
Indianapolis	822	154	164	29.16	30.04	+ .05	75.8	— 0.4	92	17	85	56	1	66	27	67	62	65	3.67	— 0.6	11	6,527	s.	40	w.	18	10	18	3	4.3	
Cincinnati	628	152	157	29.37	30.04	+ .04	77.4	0.0	96	17	87	59	11	68	26	68	64	66	3.47	+ 0.1	7	4,440	sw.	30	w.	19	14	12	5	4.0	
Columbus	824	87	100	29.16	30.02	+ .02	75.2	+ 0.3	95	17	86	54	11	65	31	67	63	70	4.70	+ 1.5	12	7,149	sw.	49	w.	18	9	12	10	5.3	
Pittsburg	842	116	123	29.13	30.01	+ .02	75.4	+ 0.4	93	6	84	56	11	67	25	67	64	70	2.94	— 1.8	16	3,888	nw.	22	nw.	6	13	15	3	4.2	
Parkersburg	638	77	84	29.38	30.06	+ .05	75.6	+ 0.8	96	17	86	56	2	65	31	68	65	74	1.85	— 2.8	7	3,216	sw.	28	n.	18	15	12	4	3.8	
Elkins	1,940	41	50	28.05	30.05	+ .04	70.2	.....	89	7	82	49	23	58	38	65	63	85	6.23	.....	13	2,468	w.	28	ne.	3	6	18	7	5.8	
Lower Lake Region.							**71.6**	**+ 0.4**											**76**	**5.43**	**+ 2.3**									**3.8**	
Buffalo	767	178	206	29.17	29.99	+ .02	69.8	+ 0.1	85	31	75	53	1	64	17	64	61	77	4.53	+ 1.4	19	8,365	sw.	45	sw.	3	6	13	12	6.4	
Oswego	335	76	91	29.60	29.96	.00	67.6	— 1.4	85	14	75	53	1	61	23	63	60	79	6.48	+ 3.4	17	5,692	s.	28	nw.	7	13	9	9	4.8	
Rochester	523	81	90	29.42	29.97	.00	70.8	+ 0.4	91	7	79	52	1	62	24	64	61	76	4.43	+ 1.5	17	5,330	sw.	30	w.	7	9	11	11	5.7	
Erie	713	92	102	29.24	30.00	+ .02	71.0	0.0	88	27	78	53	1	64	23	66	63	78	5.97	+ 3.2	15	6,339	w.	30	w.	17	12	12	7	5.2	
Cleveland	762	190	201	29.20	30.00	+ .01	72.2	+ 0.7	91	27	80	53	11	65	25	67	63	75	5.14	+ 1.6	14	8,767	s.	48	nw.	9	15	10	6	4.4	
Sandusky	629	62	70	29.35	30.02	+ .03	74.4	+ 1.3	93	17	83	57	1	66	24	.....	.....	.....	5.33	+ 2.2	14	5,252	sw.	25	nw.	18	19	9	3	3.2	
Toledo	628	123	127	29.33	30.00	+ .01	74.6	+ 1.2	92	17	83	52	1	66	25	67	63	72	4.01	+ 1.0	14	6,166	sw.	33	s.	2	15	11	5	3.7	
Detroit	730	153	193	29.20	29.98	.00	72.8	+ 1.2	91	4	81	49	1	64	25	66	63	75	7.55	+ 4.2	17	7,068	sw.	38	sw.	14	13	11	7	4.7	
Upper Lake Region.							**69.7**	**+ 1.4**											**76**	**4.16**	**+ 1.1**									**5.6**	
Alpena	609	63	80	29.31	29.98	+ .01	67.2	+ 1.9	92	6	77	47	16	58	33	61	58	76	5.60	+ 2.7	15	6,270	se.	32	nw.	15	9	11	11	5.5	
Escanaba	612	43	57	29.29	29.94	— .03	66.9	+ 0.2	88	17	75	50	10	59	26	62	59	77	2.31	— 0.9	12	5,848	s.	26	n.	9	8	7	16	6.4	
Grand Haven	632	54	92	29.30	29.96	— .02	69.2	+ 0.4	85	8	76	52	1	62	23	65	63	82	4.85	+ 2.1	11	7,398	sw.	32	sw.	17	9	14	8	5.2	
Houghton	668	66	74	29.20	29.92	— .04	68.0	.....	86	24	78	49	3	58	28	.....	.....	.....	2.74	.....	9	4,684	e.	28	sw.	7	16	9	6	4.1	
Marquette	734	79	116	29.15	29.95	— .01	66.6	+ 1.7	90	7	75	50	3	58	33	60	55	69	2.14	— 0.9	14	6,334	nw.	44	sw.	30	10	13	8	5.6	
Port Huron	638	70	120	29.32	30.02	+ .04	71.0	+ 2.5	90	6	81	46	1	61	30	66	63	81	5.29	+ 2.9	18	6,272	sw.	60	sw.	27	8	14	9	5.3	
Sault Ste. Marie	614	40	61	29.27	29.92	— .05	65.4	— 3.6	84	6	75	45	16	56	31	61	57	76	2.20	— 0.8	14	4,634	w.	40	nw.	7	7	16	8	5.5	
Chicago	823	241	274	29.12	29.99	+ .01	72.4	+ 0.4	90	30	80	54	1	65	25	67	65	79	5.78	+ 2.3	17	10,274	sw.	69	sw.	17	12	13	6	4.7	
Milwaukee	681	124	142	29.26	29.98	+ .01	71.1	+ 1.9	91	13	80	53	1	62	31	64	61	76	4.82	+ 1.7	17	6,909	sw.	44	sw.	16	11	9	11	5.6	
Green Bay	617	49	57	29.29	29.95	— .02	71.3	+ 1.3	91	13	81	51	10	62	28	63	60	74	4.10	+ 0.7	11	7,304	sw.	47	nw.	30	1	15	15	7.5	
Duluth	702	95	116	29.16	29.91	— .04	66.2	+ 0.3	86	23	74	48	5	58	31	59	55	71	4.54	+ 0.8	13	6,299	ne.	39	nw.	29	4	18	9	6.2	
North Dakota.							**68.3**	**— 0.2**											**66**	**2.93**	**+ 0.1**									**3.6**	
Moorhead	935	54	60	28.91	29.90	— .04	68.8	+ 1.2	93	24	80	46	10	57	34	63	59	73	2.82	— 1.1	9	5,798	se.	36	nw.	29	15	9	7	3.9	
Bismarck	1,674	16	29	28.15	29.90	— .03	68.8	— 0.7	98	15	81	43	9	56	37	61	56	66	2.54	+ 0.2	8	6,020	nw.	38	n.	13	23	5	3	3.4	
Williston	1,875	15	31	27.94	29.87	— .05	67.4	— 1.1	92	15	81	44	8	54	42	57	51	60	3.43	+ 1.3	6	5,472	n.	48	w.	27	25	3	3	3.6	

TABLE I.—*Climatological data for Weather Bureau Stations, July, 1902*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.									Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Direction.	Date.				
Upper Miss. Valley.							**75.2**	**+ 0.2**										**73**	**4.40**	**+ 0.6**									**4.8**	
Minneapolis		99	208				71.6	— 0.0	88	29	81	54	20	62	26				6.05	+ 2.2	14	7,833	s.	46	e.	16	3	14	14		
St. Paul	837	114	124	29.03	29.92	— .03	71.4	— 0.1	88	29	80	55	10	62	25	64	60	73	5.50	+ 2.2	15	4,896	sw.	48	nw.	22	9	15	7	5.5	
La Crosse	714	71	87	29.20	29.95	— .01	72.6	— 0.3	91	30	82	53	10	63	30				5.75	+ 1.7	13	5,011	s.	30	sw.	5	12	11	8	5.0	
Davenport	606	71	79	29.32	29.95	— .02	75.0	0.0	92	17	84	53	1	66	31	68	65	75	6.38	+ 2.7	15	4,646	sw.	33	n.	16	16	9	6	4.1	
Des Moines	861	84	88	29.06	29.96	— .00	74.5	0.0	93	16	83	54	1	66	25	68	65	74	5.95	+ 2.4	13	5,956	sw.	36	w.	7	6	16	9	5.6	
Dubuque	698	100	117	29.22	29.96	— .01	73.4	— 0.9	90	16	83	53	1	64	30	67	64	74	6.80	+ 2.5	16	4,166	s.	30	nw.	16	6	16	9	6.3	
Keokuk	614	63	78	29.32	29.96	— .02	76.6	— 0.3	94	*	86	54	1	68	23	69	67	75	4.87	+ 0.8	11	4,820	sw.	25	w.	25	13	14	4	4.1	
Cairo	356	87	93	29.66	30.03	+ .03	80.1	+ 1.2	97	17	89	63	12	71	26	72	68	71	0.40	— 3.0	3	4,790	sw.	24	sw.	28	14	14	3	3.9	
Springfield, Ill	644	82	93	29.33	30.00	+ .02	76.7	+ 0.7	94	17	86	55	1	67	25	69	66	73	1.41	— 1.4	7	5,734	sw.	35	ne.	16	10	16	5	4.5	
Hannibal	534	75	110	29.42	29.98	.00	77.0	+ 0.3	94	17	87	56	21	68	26				2.96	— 1.6	9	6,097	s.	34	se.	1	11	14	6	4.7	
St. Louis	567	111	210	29.41	30.00	+ .01	80.3	+ 1.5	96	17	89	61	1	72	23	71	68	70	2.34	— 1.4	11	5,700	s.	35	w.	9	13	15	3	4.2	
Missouri Valley.							**74.7**	**— 0.4**										**70**	**5.34**	**+ 1.6**									**4.2**	
Columbia	784	11	84	29.17	29.97	— .01	76.6	+ 0.2	94	15	87	55	21	67	26				7.66	+ 3.4	7	4,687	s.	34	ne.	31	9	17	5	4.7	
Kansas City	963	78	95	28.98	29.98	+ .01	77.6	+ 0.1	95	15	86	59	1	69	26	70	67	74	9.63	+ 5.4	12	5,975	s.	27	s.	4	15	11	5	4.3	
Springfield, Mo	1,324	98	104	28.64	30.01	+ .03	76.0	+ 0.3	92	15	84	59	21	68	24	71	68	80	4.04	— 0.3	7	6,565	s.	35	w.	9	20	10	1	3.2	
Topeka		81	89				77.0	— 0.4	96	15	86	57	21	67	28				3.87	— 1.1	12	6,659	s.	30	s.	4	11	17	3	4.7	
Lincoln	1,189	75	84	28.67	29.90	— .05	74.4	— 2.4	96	16	84	55	10	65	29	68	65	75	11.35	+ 7.5	15	7,407	s.	50	n.	13	17	10	4	3.8	
Omaha	1,105	115	121	28.77	29.92	— .03	74.8	— 1.4	96	16	84	56	10	66	25	68	65	74	7.28	+ 2.5	13	5,393	s.	46	ne.	12	13	11	7	5.0	
Valentine	2,598	47	54	27.22	29.88	— .05	72.4	— 0.9	106	15	86	47	20	59	41	60	53	58	1.79	— 0.7	10	7,935	s.	46	ne.	23	19	8	4	3.5	
Sioux City	1,135	96	164	28.73	29.91	— .04	73.4	— 0.9	92	30	83	50	10	64	29				5.03	+ 1.7	14	8,137	s.	47	s.	5	13	11	7	4.8	
Pierre	1,572	43	50	28.24	29.86	— .07	75.0	+ 0.4	108	15	87	54	9	63	42	62	54	55	1.18	— 1.0	12	5,534	se.	42	w.	31	20	7	4	3.6	
Huron	1,306	56	67	28.53	29.90	— .04	71.4	+ 0.5	101	29	84	48	10	58	44	64	61	74	1.53	— 1.6	11	7,406	s.	42	s.	3	12	17	2	4.2	
Yankton	1,233	42	49	28.60	29.89	— .05	73.2	— 0.4	94	29	84	49	10	62	33				4.18	+ 0.4	14	4,964	s.	34	s.	3	17	11	3	3.9	
Northern Slope.							**67.0**	**— 2.4**										**58**	**1.97**	**+ 0.3**									**4.0**	
Havre	2,505	46	53	27.29	29.89	— .02	66.0	— 1.5	98	31	79	45	9	53	41	56	49	60	0.79	— 1.4	5	6,785	sw.	40	sw.	4	18	10	3	3.6	
Miles City	2,371	42	50	27.39	29.83	— .09	71.4	— 2.3	98	11	85	48	7	58	38	64	60	70	1.12	— 0.2	7	4,186	e.	40	w.	13	21	9	1	3.0	
Helena	4,110	88	94	25.80	29.91	.00	63.2	— 4.0	92	21	74	40	8	52	36	50	40	49	1.98	+ 0.9	6	5,982	sw.	30	w.	15	14	10	7	4.7	
Kalispell	2,965	45	51	26.90	29.91	— .02	59.8	.....	89	21	73	35	3	47	38	50	42	61	2.65	.....	6	4,274	w.	42	sw.	15	17	8	6	3.6	
Rapid City	3,234	46	50	26.58	29.87	— .06	68.8	— 2.5	102	15	81	48	20	57	40	58	50	56	3.59	+ 1.9	9	5,613	se.	46	w.	13	14	13	4	4.0	
Cheyenne	6,088	56	64	24.08	29.91	— .01	63.8	— 3.1	93	15	78	40	20	50	39	51	42	52	1.49	— 0.3	11	6,406	s.	41	w.	6	10	14	7	5.1	
Lander	5,372	26	36	24.67	29.91	— .01	63.4	— 2.6	94	31	80	35	9	46	45	50	40	50	0.29	— 0.6	6	3,051	sw.	32	s.	2	11	20	0	3.8	
North Platte	2,821	43	52	27.06	29.92	— .01	72.4	— 1.1	100	15	84	51	20	61	35	63	58	67	4.56	+ 1.8	10	6,090	se.	34	ne.	17	13	16	2	4.2	
Middle Slope.							**75.4**	**— 0.9**										**63**	**2.71**	**— 0.2**									**4.2**	
Denver	5,291	79	151	24.77	29.99	.00	70.2	— 1.5	100	15	85	46	6	56	41	53	42	47	1.24	— 0.5	5	5,789	sw.	45	nw.	18	8	17	6	5.1	
Pueblo	4,685	80	86	25.30	29.87	— .04	72.4	— 1.6	100	15	87	50	6	58	43	56	45	47	0.95	— 1.2	5	5,317	se.	38	nw.	5	14	17	0	3.5	
Concordia	1,398	42	47	28.49	29.92	— .03	76.2	— 0.9	96	15	86	52	21	66	30	68	65	73	4.37	+ 0.8	14	6,124	s.	30	s.	4	11	16	4	4.6	
Dodge	2,509	44	52	27.37	29.91	— .02	76.9	— 0.7	98	14	89	56	20	65	34	66	62	68	3.73	+ 0.6	5	9,225	se.	42	se.	4	24	5	2	3.9	
Wichita	1,358	78	85	28.56	29.96	.00	78.0	— 0.4	95	15	88	60	20	68	27	70	66	72	4.12	+ 0.9	9	6,248	s.	34	nw.	6	15	13	3	3.6	
Oklahoma	1,214	79	86	28.70	29.95	— .01	78.9	— 0.1	95	2	88	65	21	70	24	70	66	71	1.85	— 1.9	7	8,163	s.	38	s.	4	6	15	10	5.6	
Southern Slope.							**77.2**	**— 2.2**										**67**	**4.64**	**+ 2.1**									**6.0**	
Abilene	1,738	45	54	28.17	29.93	.00	79.4	— 3.3	96	17	88	65	22	70	26	70	65	69	7.82	+ 6.1	11	6,959	se.	30	se.	4	5	12	14	6.9	
Amarillo	3,676	43	52	26.23	29.87	— .05	75.0	— 1.0	95	6	85	59	23	65	27	64	58	65	1.45	— 1.9	8	10,071	s.	42	s.	4	8	16	7	5.1	
Southern Plateau.							**76.9**	**— 3.1**										**37**	**1.11**	**— 0.3**									**2.6**	
El Paso	3,762	10	110	26.16	29.83	— .01	77.9	— 4.0	100	30	89	61	21	66	32	62	53	54	3.27	+ 1.2	12	7,407	ne.	46	ne.	9	10	14	7	5.0	
Santa Fe	7,013	47	50	23.35	29.85	— .03	67.4	— 1.1	90	30	79	48	6	56	28	51	39	40	1.50	— 1.3	7	4,834	se.	33	ne.	22	18	12	1	3.2	
Flagstaff	6,907	12	25	23.42	29.81	— .01	63.0	— 4.7	92	14	80	35	6	46	44	47	.....	.....	1.28	— 1.2	3	.....	sw.	48	sw.	2	15	14	2	3.5	
Phoenix	1,108	50	56	28.65	29.76	— .02	88.6	— 1.3	111	31	103	65	6	74	38	64	46	28	0.32	— 0.7	4	3,893	w.	34	e.	22	26	4	1	1.2	
Yuma	141	16	50	29.60	29.74	— .02	87.5	— 4.0	111	12	102	64	3	73	38	68	58	43	0.11	0.0	2	4,870	w.	26	se.	23	30	0	1	0.5	
Independence	3,910	51	58	25.92	29.82	— .01	77.0	— 3.3	100	24	90	49	3	64	40	54	30	20	0.17	+ 0.1	1	6,320	nw.	52	nw.	2	24	5	2	2.2	
Middle Plateau.							**70.0**	**— 3.2**										**33**	**0.57**	**+ 0.2**									**2.9**	
Carson City	4,720	82	92	25.28	29.89	+ .02	65.6	— 2.4	96	24	82	36	2	49	44	50	38	44	0.02	— 0.2	1	4,974	w.	39	sw.	1	20	9	2	2.6	T.
Winnemucca	4,344	59	70	25.60	29.91	+ .01	66.6	— 4.8	97	20	83	33	2	50	45	51	38	39	0.88	+ 0.7	3	5,974	sw.	36	sw.	14	20	4	7	3.2	T.
Modena	5,479	10	38	24.62	29.83	— .03	68.3	.....	96	24	86	31	3	51	46	46	22	23	T.	.....	0	8,692	sw.	58	s.	2	20	9	2	2.6	T.
Salt Lake City	4,366	105	110	25.58	29.85	— .05	72.5	— 3.0	96	30	85	43	3	60	36	52	34	27	0.56	0.0	4	4,967	se.	35	nw.	2	22	5	4	2.6	
Grand Junction	4,608	43	51	25.35	29.86	— .03	75.3	— 2.4	101	15	90	48	6	60	40	53	35	31	0.81	+ 0.3	6	4,764	nw.	31	se.	11	17	9	5	3.6	
Northern Plateau.							**67.3**	**— 3.8**										**47**	**0.91**	**+ 0.4**									**3.3**	
Baker City	3,471	53	58	26.44	29.98	+ .03	62.2	— 3.8	95	20	76	38	7	48	40	47	34	42	0.10	— 0.5	2	4,354	nw.	26	sw.	10	20	4	7	3.7	
Boise	2,739	61	68	27.12	29.93	.00	69.4	— 3.7	102	20	84	41	7	54	41	52	36	38	0.75	+ 0.6	3	3,090	nw.	23	nw.	1	23	4	4	2.8	
Lewiston	757	52	61	29.13	29.93	— .02	70.6	— 3.4	104	20	84	47	7	57	41	.....	.....	.....	1.19	+ 0.7	5	3,106	e.	44	sw.	14	23	2	6	2.6	
Pocatello	4,482	46	54	25.47	29.89	— .03	67.0	— 3.3	95	21	82	38	3	52	39	51	40	43	0.34	— 0.1	6	6,185	se.	34	sw.	2	18	11	2	2.7	
Spokane	1,943	101	110	27.94	29.95	— .02	64.9	— 4.1	94	20	77	44	7	53	38	52	43	53	1.71	+ 1.0	5	5,486	sw.	52	w.	15	10	12	9	5.1	
Walla Walla	1,000	65	73	28.90	29.95	— .02	69.8	— 4.2	100	20	82	46	2	57	37	61	55	61	1.35	+ 1.0	3	4,588	s.	42	n.	14	24	5	2	2.9	
N. Pac. Coast Reg.							**61.3**	**— 0.7**										**70**	**1.65**	**+ 0.7**									**4.6**	
Neah Bay	50	7	50	30.00	30.04	— .01	57.2	— 1.7	77	20	63	45	8	51	21	54	51	82	1.37	— 0.9	8	7,436	sw.	36	sw.	4	7	15	9	5.6	
Port Crescent	259	13	20	29.81	30.05	— .01	56.0	— 0.3	86	25	65	38	7	47	40	.....	.....	.....	0.79	+ 0.2	5	3,968	w.	30	sw.	14	14	11	6	4.3	
Seattle	123	114	151	29.93	30.06	+ .02	63.8	+ 0.6	95	19	73	48	8	55	34	55	50	67	2.01	+ 1.4	9	4,814	n.	48	w.	14	13	9	9	4.5	
Tacoma	213	113	120	29.83	30.05	— .01	62.3	+ 0.3	94	19	72	46	8	53	36	.....	.....	.....	1.91	+ 1.1	6	4,524	n.	40	sw.	14	8	15	8	5.5	
Astoria	20	57	64	.....	.....	.....	60.3	— 1.2	82	18	68	47	2	53	28	.....	.....	.....	2.89	+ 1.8	10	.....	nw.	.....	.....	.....	12	11	8	4.9	
Portland, Oreg	154	203	213	29.88	30.03	— .02	65.2	— 1.1	95	19	75	46	7	55	33	57	51	65	1.76	+ 1.2	8	4,234	nw.	29	sw.	15	18	7	6	3.8	
Roseburg	518	56	67	29.48	30.03	.00	64.6	— 1.7	96	18	78	42	8	52	38	55	49	65	0.79	+ 0.3	4	3,286	n.	28	sw.	14	17	9	5	3.3	
Mid. Pac. Coast Reg.							**64.4**	**+ 0.1**										**60**	**0.05**	**0.0**									**2.5**	
Eureka	62	62	80	29.99	30.05	.00	56.2	+ 0.4	69	31	61	46	1	52	16	53	50	83	0.25	+ 0.2	5	5,151	nw.	31	n.	6	12	11	8	4.4	
Mount Tamalpais	2,375	11	18	27.52	29.95	.00	67.3	.....	100	24	75	42	2	60	35	52	40	47	0.03	.....	2	13,670	nw.	69	nw.	2	24	3	4	1.9	
Red Bluff	332	50	56	29.52	29.86	— .03	80.0	— 1.8	115	24	94	55	2	66	38	60	43	33	0.00	0.0	0	4,391	n.	35	nw.	2	28	2	1	0.9	
Sacramento	69	106	117	29.79	29.86	— .02	73.2	+ 0.6	107	24	88	53	3	58	40	60	52	56	0.00	0.0	0	6,634	s.	30	nw.	1	28	2	1	1.3	
San Francisco	155	161	167	29.80	29.97	+ .02	59.2	+ 0.9	77	11	66	47	10	53	25	54	52	82	T.	0.0	0	3,733	w.	38	w.	24	23	6	2	2.2	
Point Reyes Light	490	7	30	29.41	29.94	.....	54.0	+ 0.2	66	24	58	47	*	50	13	.....	.....	.....	0.00	— 0.3	0	21,048	nw.	90	nw.	2	18	3	10	4.1	
S. Pac. Coast Reg.							**69.5**	**— 1.1**										**66**	**0.23**	**+ 0.2**									**3.2**	
Fresno	330	67	70	29.49	29.84	+ .01	80.4	— 1.1	110	23	97	54	4	64	39	59	41	32	0.00	0.0	0	5,324	nw.	20	nw.	1	26	5	0	1.4	
Los Angeles	338	74	82	29.56	29.91	+ .01	68.4	— 0.9	93	13	78	52	3	58	37	61	58	78	T.	0.0	0	3,276	w.	13	sw.	22	9	19	3	4.6	
San Diego	87	94	102	29.81	29.90	— .02	65.4	— 1.7	76	24	70	55	13	61	19	61	59	82	0.92	+ 0.9	3	4,284	nw.	20	sw.	4	19	8	4	3.7	
San Luis Obispo	201	46	48	29.75	29.97	+ .02	63.9	— 0.8	92	12	76	45	3	52	42	56	51	74	T.	0.0	0	3,719	w.	18	n.	31	23	4	4	3.2	
West Indies.																															
Basseterre	29	41	54	29.99	30.02	+ .03	81.0	.....	87	22	86	72	4	76	14	75	73	75	3.53	.....	20	7,653	e.	24	e.	4	10	18	3	4.4	
Bridgetown	30	57	65	29.94	29.96	+ .02	80.6	+ 1.9	88	27	86	71	5	75	15	76	74	79	4.38	— 0.7	20	5,754	e.	22	e.	10	8	14	9	5.6	
Cienfuegos	52	62	67	29.95	30.01	+ .02	81.4	.....	93	13	90	70	31	73	21	74	72	78	3.46	.....	14	5,099	ne.	32	e.	3	9	21	1	4.4	
Grand Turk	11	6	20	30.04	30.05	+ .03	83.2	.....	91	15	90	71	31	76	19	.....	.....	.....	1.54	.....	12	.....	e.	.....	.....	.....	10	18	3	5.1	
Havana	57	87	105	29.97	30.02	+ .02	81.0	— 1.4	91	28	88	69	19	74	20	76	74	82	2.37	— 2.7	7	8,310	e.	46	e.	4	13	16	2	4.1	
Kingston	286	38	52	29.66	29.95	.00	80.4	.....	93	26	90	68	8	71	22	72	70	73	0.87	.....	6	4,656	ne.	26	se.	26	7	22	2	4.9	
Port of Spain	40	65	66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Puerto Principe	352	55	62	29.67	30.03	+ .03	80.7	.....	94	26	90	67	12	71	25	74	72	83	5.83	.....	14	5,979	ne.	30	se.	20	13	16	2	4.3	
Roseau	25	37	47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
San Juan	82	48	90	29.94	30.03	+ .04	80.3	.....	87	12	86	71	23	75	15	76	74	80	4.61	— 1.1	22	9,315	e.	29	e.	17	7	21	3	5.2	
Santiago de Cuba	82	46	52	29.91	29.99	+ .01	80.2	.....	92	10	90	67	13	71	23	74	71	77	1.46	.....	10	4,570	n.	27	ne.	13	7	22	2	5.2	
Santo Domingo†	57	37	44	29.95	30.01	+ .02	79.4	.....	90	28	87	70	30	72	19	75	73	83	1.64	.....	9	2,699	n.	20	se.	23	3	14	3	5.5	
Willemstad	75	39	46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

NOTE.—The data at stations having no departures are not used in computing the district averages. *More than one date. † Record for 19 days only, July 13th to 31st, inclusive.

TABLE II.—*Climatological record of voluntary and other cooperating observers, July, 1902.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Ashville	105	56	80.9	3.07	
Bermuda	103	65	82.6	8.52	
Birmingham	102	62	83.6	2.21	
Bridgeport				4.18	
Burkeville				2.45	
Calera				3.07	
Citronelle	99	67	82.2	5.37	
Clanton	99	63	81.9	1.87	
Cordova	104	56	82.6	0.51	
Daphne	98	67	82.0	2.25	
Decatur	107	60	84.4	1.94	
Demopolis				1.25	
Dothan	101			2.44	
Elba	104	65	83.4	2.33	
Eufaula *a*	104	68	84.2	2.87	
Eutaw	102	68	84.4	1.45	
Evergreen	101	66	82.9	6.63	
Flomaton [1]	101	60	80.8		
Florence *a*				2.20	
Florence *b*	104	58	82.2	3.56	
Fort Deposit	102	66	83.9	1.73	
Gadsden	105	59	83.4	2.14	
Goodwater	105	63	82.8	6.63	
Greensboro				2.01	
Greenville				3.65	
Hamilton	103	54	80.7	1.80	
Helena				1.20	
Highland Home	100	67	82.8	1.39	
Letohatchie				0.20	
Livingston *a*	102	66	83.2	1.22	
Lock No. 4	109	65	86.0	1.25	
Madison Station	104	57	82.8	0.60	
Maplegrove	107	55	82.2	2.01	
Marion	105	66	83.6	2.03	
Milstead				2.03	
Newbern	106	64	84.4	4.48	
Notasulga				2.59	
Oneonto	97	60	80.2	3.03	
Opelika	101	65	82.8	3.53	
Oxanna	102	60	82.2	2.09	
Ozark	103	68	83.6	3.00	
Prattville	102	60	82.4	2.70	
Pushmataha	101	54	82.0	4.72	
Riverton	101	56	79.8	2.03	
Scottsboro	100	53	80.0	2.22	
Selma	104	65	84.8	1.97	
Talladega	105	67	84.5	3.59	
Tallassee				0.75	
Thomasville	103	68	84.3	2.71	
Tuscaloosa	104	62	85.0	1.08	
Tuscumbia	102	62	83.4	2.15	
Tuskegee	103	67	84.3	2.11	
Union Springs	104	68	83.8	4.80	
Uniontown	103	60	83.8	0.52	
Valleyhead	100	53	80.8	2.03	
Verbena				1.07	
Wetumpka	106	64	85.6	1.33	
Alaska.					
Coal Harbor	78	42	55.9	1.70	
Fort Egbert	82	40	60.9	2.50	
Fort Liscum	77	32	51.1	3.65	
Juneau	72	43	54.8	7.60	
Kenai	75	35	55.6	1.71	
Ketchikau	69	51	58.6	5.62	
Killisnoo	72	45	55.9	3.80	
Nushagak	78	38	59.6	3.00	
Point Barrow	62	30	39.7	1.51	
Sitka	74	38	55.5	7.35	
Skagway	76	39	57.1	2.95	
Teller	76	32	51.0	2.98	
Tyoonok	82	42	58.9	2.93	
Arizona.					
Agua Caliente	112	54	83.2	0.00	
Allaire Ranch				1.48	
Arizona Canal Co's Dam	110	61	87.0	0.83	
Ashfork	98	38	68.0	0.30	
Aztec *1	119	82	97.2	T.	
Benson *1	102	76	86.2	T.	
Bisbee	97	59	75.0	0.54	
Buckeye	108	57	84.3	0.00	
Casagrande *1	114	77	90.6	0.00	
Champie Camp	115	56	86.3	0.30	
Cochise *5	98	72	84.4	0.36	
Congress	104	63	83.8	T.	
Dragoon Summit *1	95	68	78.5	0.00	
Dudleyville	109	56	82.4	0.19	
Duncan	104	33	74.5	T.	
Fort Apache	102	44	71.1	1.63	
Fort Defiance	94	39	66.0	0.22	
Fort Grant	103	51	74.9	0.90	
Fort Huachuca	98	61	80.6	0.89	
Fort Mohave [1]	117	62	89.8	0.00	
Gilabend *1	112	72	88.9	0.00	
Globe	107	50	79.9	0.90	
Jerome	101	56	78.8	1.20	
Kingman [1]	104	58	81.0	0.00	
Maricopa *1	112	80	92.8	0.34	
Mesa	111	60	86.9	0.56	
Arizona—Cont'd.					
Mesa (near)	111	60	87.0	0.00	
Mohawk Summit *1	118	79	94.7	0.42	
Mount Huachuca	100	50	76.2	1.19	
Natural Bridge				1.20	
Nogales	103	52	77.6	0.86	
Oracle	99	62	79.8	0.66	
Oro				0.89	
Phoenix	113	60	87.2	0.45	
Pima	108	53	83.2	0.22	
Pinal Ranch				1.83	
Prescott	95	40	69.6	0.28	
St. Johns	103	42	73.0	0.06	
Sentinel *1	112	85	97.2	0.00	
Showlow				0.70	
Signal	116	56	86.9	0.75	
Superstition				0.58	
Taylor	102	43	71.2	0.22	
Tombstone	101	61	78.0	0.85	
Tonto	109	55	83.0	0.05	
Tuba	105	46	77.9	0.37	
Tucson	108	59	84.4	0.42	
Vail *5	103	74	85.8	0.12	
Walnut Grove				0.10	
Willcox *1	100	65	80.5	0.40	
Williams	98	40	67.5	0.70	
Yarnell				0.64	
Arkansas.					
Alco	96	59	78.2	0.97	
Amity	97	60	79.9	4.00	
Arkadelphia	104	57	80.4	5.50	
Arkansas City				6.40	
Batesville	101	60	81.4	1.98	
Beebranch [j]	99	61	80.2		
Blanchard Springs	95	65	79.8	5.77	
Brinkley	99	57	79.9	5.16	
Camden *a*				10.39	
Camden *b*	97	61	81.0	11.92	
Conway	104	63	82.1	7.71	
Corning	98	58	79.1	0.98	
Dallas	94	59	77.6	3.01	
Dardanelle				6.35	
De Queen	97	61	80.8	6.75	
Dutton	89	59	73.8	2.80	
Elon	100[d]	57[d]	81.2[d]	6.33	
Eureka Springs	96	62	77.4	4.34	
Fayetteville	104	56	79.4	0.37	
Forrest City [d]	101	57	80.8	1.81	
Fulton				10.08	
Helena *a*				1.75	
Helena *b*	100	61	80.1	1.94	
Jonesboro				0.83	
Keesees Ferry	99	58	78.6	1.46	
Lacrosse	100	60	79.4	0.50	
Lake Village	99	58	80.8	4.34	
Lonoke	103	50	80.0	8.15	
Lutherville	95	59	77.2	3.71	
Malvern	102	57	80.6	5.50	
Marianna	99	59	81.2	4.47	
Marvell	101	58	81.0	8.01	
Mossville	88	57	73.7		
Mountain Home	98	57	78.4	1.31	
Mount Nebo	91	55	75.6	8.41	
New Gascony	106	54	81.5	8.27	
Newport *a*				1.62	
Newport *b*	102	58	81.2	1.50	
Newport *c*	99	58	79.8	1.79	
Oregon	98	55	76.9	1.74	
Ozark	101	63	82.2	4.10	
Perry	98	58	80.0		
Pinebluff	101	57	81.6	5.60	
Pocahontas	100	55	79.4	1.52	
Pond	98	50	76.8	2.50	
Prescott	96	61	79.8	11.98	
Princeton	98	51	79.5	8.64	
Rison	105	60	83.4	5.75	
Rosadale	98	65	81.4	5.81	
Russellville	96	63	80.4	4.43	
Silversprings	94	57	77.0	1.79	
Spielerville	100	60	80.2	3.81	
Stuttgart	99	54	79.5	7.04	
Texarkana	96	67	80.5	13.94	
Warren		56		4.33	
Washington	91	65	78.4	11.91	
Wiggs	96	55	77.7	6.63	
Winchester	103	59	80.4	8.01	
Winslow	88	57	74.8	1.46	
Witts Springs	98	60	74.9	1.51	
California.					
Angiola	113	45	77.5	T.	
Azusa	100	48	72.7	T.	
Bakersfield	111	48	78.4	0.00	
Ballast Point L. H				1.05	
Berkeley	81	49	63.0	0.00	
Bishop	105[e]	40[e]	72.2[e]	T.	
Boca *1	93	25	62.1	0.10	1.0
Bodie	85	17	54.4	0.03	
Bowman	102	38	66.7	0.09	
Branscomb				0.01	
California—Cont'd.					
Caliente *1	109	60	84.3	0.00	
Campbell	97	41	65.4	0.00	
Campo				2.24	
Cape Mendocino L. H				0.05	
Cedarville	99	32	65.4	1.15	T.
Chico	114	49	76.2	0.00	
Chino *1	102	55	73.1	0.00	
Cisco *1	88	30	57.1	T.	
Claremont	106	45	69.1	0.05	
Cloverdale	110	45	72.7	0.00	
Colusa	110	55	76.6	0.00	
Corning *1	112	62	80.3	0.00	
Coronado	79	56	66.9	1.36	
Crescent City	75	39	56.6	0.47	
Crescent City L. H				0.35	
Cuyamaca	84	39	60.8	1.54	
Delano *1	112	60	87.0	0.00	
Delta *1	108	53	76.6	T.	
Drytown	111	48	75.0		
Dunnigan *1	114	61	82.8	0.00	
Durham *5	114	58	77.2	0.00	
East Brother L. H				0.00	
Edmanton *1	97	40	63.4	0.13	
Elcajon	101	48	69.4	0.75	
Elmdale	114	48	76.0	0.00	
Elsinore	107	46	73.5	0.08	
Escondido	99	42	71.2	0.15	
Fallbrook	103	46	70.0	0.23	
Folsom *1	112	61	78.6	0.00	
Fordyce Dam				0.06	0.5
Fort Bragg				0.00	
Fort Ross	72	42	57.8	0.00	
Foster				0.62	
Georgetown	105	41	72.6	0.00	
Geyserville	100	70	85.0	0.00	
Gilroy (near)	100	41	66.2	0.00	
Goshen *5	112	50	82.7	0.00	
Grass Valley				0.00	
Greenville	102	32	62.8	0.43	
Hanford	113	46	79.6	0.00	
Healdsburg	102	38	69.0	T.	
Hollister	99	40	66.2	0.00	
Humboldt L. H				0.25	
Idylwild	90	32	62.8	0.33	
Imperial	115	51	88.2	0.55	
Indio *1	114	72	88.8	0.10	
Iowa Hill *1	100	54	71.4	0.00	
Jackson	101	48	73.6	0.00	
Kennedy Gold Mine	104	42	71.1	0.00	
Kent				T.	
King City	103	40	68.1	0.00	
Kono Tayee	101	50	73.6	0.00	
Laguna Valley				2.32	
Lamesa				0.93	
Laporte *1	91	40	59.0	0.02	
Las Fuentes Ranch				0.00	
Legrande	115	48	79.6	0.00	
Lemoncove	112	50	79.8	T.	
Livermore	111	41	71.6	T.	
Lick Observatory	93	30	66.7	0.00	
Lime Point L. H				0.00	
Lodi	108	49	72.8	0.00	
Los Gatos	99	45	68.0	0.00	
Mammoth *1	113	70	89.3	0.00	
Manzana	108	52	81.5	0.00	
Mare Island L. H				0.00	
Merced	114	48	77.4	0.00	
Mercury	104	50	75.8	T.	
Mills College				0.00	
Milo				T.	
Milton (near)	111	52	76.3	0.00	
Modesto *1	111	62	81.5	0.00	
Mohave *1	105	60	80.4	0.00	
Monterio	98	46	70.2	0.00	
Monterey *1	72	49	60.2	0.00	
Mount St. Helena				0.00	
Napa	102	48	69.8	0.00	
Needles	111	70	93.0	0.12	
Nevada City	101	41	66.2	0.00	
Newhall	109	58	73.4	0.00	
Newman	113	49	77.8	T.	
Niles	96	46	67.2	0.00	
North Bloomfield	109	42	70.6	0.09	
North Ontario	99	50	70.6	0.00	
North San Juan *1	105	47	69.0	0.00	
Oakland	86	51	65.2	0.00	
Ogilby *1	118	75	95.4	0.04	
Orland *1	115	60	88.2	0.00	
Palermo	117	49	76.0	0.00	
Paso Robles	109	40	69.1	0.00	
Peachland *5	94	52	68.2	0.08	
Piedras Blancas L. H				0.00	
Pigeon Point L. H				0.00	
Pilot Creek				0.38	
Pine Crest	91	51	66.0	0.00	
Placerville	102	41	68.8	0.00	
Point Ano Nuevo L. H				0.00	
Point Arena L. H				0.00	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Point Bonita L. H.				0.00	
Point Conception L. H				0.00	
Point Fermin L. H				0.00	
Point George L. H				0.38	
Point Hueneme L. H.				0.00	
Point Lobos	67	49	56.9	T.	
Point Loma L. H.				0.90	
Point Montara L. H.				0.00	
Point Pinos L. H.				0.00	
Point Sur L. H.				0.00	
Pomona (near)	103	48	74.0	0.00	
Porterville	111	44	77.8	0.01	
Poway	95	49	70.8	0.80	
Quincy	97	36	63.8	0.40	
Ranch House	91	60	72.8	T.	
Redding	111	54	79.6	0.01	
Redlands	105	51	75.2	0.07	
Reedley	112	46	79.2	0.00	
Represa	106	54	74.6	0.00	
Riovista	109	53	76.0	T.	
Riverside	101	52	72.0	T.	
Roe Island L. H.				0.00	
Rohnerville				0.34	
Rosewood	115	53	78.4	0.00	
Sacramento	105	50	72.4	0.00	
Salinas	84	42	61.8	0.00	
Salton *1	120	74	97.6	0.30	
San Bernardino	105	46	73.6	0.01	
San Jacinto	106	48	75.2	0.10	
San Jose	97	42	66.8	0.00	
San Leandro	88	47	64.5	0.00	
San Luis L. H.				0.00	
San Mateo *1	89	59	69.1	0.00	
San Miguel *1	104	56	72.3	0.00	
San Miguel Island	73	48	57.8	0.00	
Santa Barbara	86	48	65.3	0.00	
Santa Barbara L. H				0.00	
Santa Clara				0.00	
Santa Cruz	89	40	61.6	0.00	
Santa Cruz L. H.				0.00	
Santa Maria	83	44	63.7	0.00	
Santa Monica	79	48	62.8	0.00	
Santa Paula	101	50	72.1	0.00	
Santa Rosa	101	41	66.8	T.	
Shasta	114	51	81.4	0.00	
Sierra Madre	97	50	70.1	T.	
Sonoma				0.00	
S. E. Farallone L. H.				0.00	
Stockton	103	52	72.6	0.00	
Storey	114	48	77.3	0.00	
Summerdale	93	36	65.0	T.	
Susanville	95	42	67.0	0.54	
Tehama *1	117	60	85.5	0.00	
Tejon Ranch	102	51	79.8	0.00	
Trinidad L. H				0.60	
Truckee *1	90	30	54.2	0.45	3.0
Tulare *b*				0.00	
Tulare *c*	110	46	78.0	0.00	
Ukiah	112	40	68.8	0.00	
Upperlake	111	44	71.0	0.00	
Upper Mattole *1	104	46	59.5	0.07	
Vacaville *1	112	54	75.2	0.00	
Ventura	81	51	64.9	0.00	
Visalia	113	47	80.2	0.00	
Volcano *1	122	80	99.6	0.80	
Wasco	112	51	83.2	0.00	
Wheatland	111	50	73.5	0.00	
Williams *1	113	63	83.1	0.00	
Willits	112	40	68.8	0.00	
Willows	111	54	77.6	0.00	
Wire Bridge *b	111	54	78.2	0.00	
Yerba Buena L. H.				0.00	
Yreka	100	39	67.8	0.19	
Yuba City *b	106	62	79.5	0.00	
Zenia				0.19	
Colorado.					
Alford	95	38	63.4	1.33	
Arkins	99	44	67.7	0.53	
Ashcroft	89	27	55.1	1.01	
Blaine	109	48	76.3	4.25	
Boulder	97	46	69.2	1.26	
Boxelder				2.05	
Breckenridge	83	26	51.2	2.12	5.6
Buenavista				0.01	
Canyon	98	41	71.4	1.76	
Castlerock	97	36	67.6	1.46	
Cedaredge	95	35	68.0	0.98	
Cheyenne Wells	101	41	72.4	1.58	
Clearview	84	33	55.4	1.35	T.
Collbran	98	42	67.4	1.09	
Colorado Springs	91	40	65.8	1.66	
Delta	102	37	69.5	1.17	
Durango	95	35	66.4	0.91	
Fort Collins	98	39	66.0	1.31	
Fort Morgan	100	42	69.2	1.14	
Fox	102	40	71.0	2.21	
Garnett	88	29	60.6	0.63	
Gilman				1.50	
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Gleneyre	95	34	65.2	2.17	
Glenwood	94	32	62.4	0.94	
Greeley	101	40	69.6	0.65	
Grover				1.75	
Gunnison	91	29	58.5	0.51	
Hamps	93	32	65.4	0.62	
Hochne	99	37	71.4	0.72	
Holyoke (near)	103	43	70.0	2.30	
Husted	92	36	63.6	1.74	
Lake Moraine	76	30	53.0	2.25	T.
Lamar	105	47	76.8	1.83	
Laporte				0.90	
Las Animas	101	49	74.4	0.95	
Lay	97	31	62.1	0.46	
Leadville (near)				0.97	2.0
Leroy	104	46	70.4	0.98	
Longs Peak	81	27	52.0	2.40	T.
Mancos	91	31	63.2	1.23	
Marshall Pass				1.10	8.0
Meeker	95	36	63.4	1.47	
Mitchell	84	35	55.3	1.47	0.5
Montrose				0.90	
Moraine	87	32	58.2	1.45	
Pagoda	91	32	60.6	1.59	
Parachute	101	39	69.8	1.01	
Rangely	94	40	70.6	0.41	
Rockyford	102	44	73.9	0.72	
Rogers Mesa	99	38	69.3	2.04	
Ruby				0.65	6.0
Russell	88	19	56.6	0.61	
Saguache	88	31	62.6	0.25	
Salida	96	30	64.6	0.58	
San Luis	87	30	60.4	0.53	
Santa Clara	90	37	62.9	0.42	
Sapinero				0.43	
Seibert				1.15	
Silt	99	37	68.6	1.44	
Sugarloaf	95	36	63.2	1.56	
Trinidad	92	45	70.2	0.84	
Twinlakes				0.02	
Vilas				2.77	
Wagon Wheel	85	24	53.4	1.25	
Walden	89[f]	28[f]	55.8[f]	1.04	
Wallet				T.	
Westcliffe	89	35	60.6	1.71	
Whitepine	79	24	51.6	1.28	3.0
Yuma				2.70	
Connecticut.					
Bridgeport	92	49	71.0	3.28	
Canton	87	42	65.8	7.71	
Colchester	88	42	66.9	4.75	
Falls Village				7.42	
Hartford	89	52	68.7	6.51	
Hawleyville	90	46	68.8	5.08	
Lake Konomoc				4.26	
Middletown	92	46	69.5	4.28	
New London	90	52	68.5	2.23	
North Grosvenor Dale	90	45	67.5	7.34	
Norwalk	93	46	70.7	2.45	
Southington	88	46	68.2	5.65	
South Manchester				6.63	
Storrs	85	47	65.0	7.48	
Voluntown	90	44	66.9	4.19	
Waterbury	93	46	70.7	4.58	
West Cornwall	89	48	66.1	9.40	
West Simsbury				7.23	
Delaware.					
Milford	104	53	77.6	1.77	
Millsboro	101	53	76.2	2.34	
Newark	93	52	73.8		
Seaford	100	57	78.1	5.55	
District of Columbia.					
Distributing Reservoir *b	99	67	79.4	3.22	
Receiving Reservoir *b	93	66	78.8	3.94	
West Washington	100	55	76.5	3.02	
Florida.					
Archer	101	65	81.8	8.67	
Avon Park	98	69	82.5	8.68	
Bartow	95	68	82.2	3.97	
Bonifay	102	66	82.7	3.20	
Brooksville	102	69	82.1	3.53	
Carrabelle	96	67	83.2	7.08	
Clermont	103	70	83.8	4.64	
De Funiak Springs	104	66	82.0	4.72	
Deland	97	70	82.2		
Eustis	104	70	85.2	2.10	
Federal Point	102	66	82.4	3.72	
Fernandina	98	68	82.4	5.36	
Flamingo	98			2.94	
Fort Meade	100	66	82.1	9.56	
Fort Myers	94	67	80.6	4.60	
Fort Pierce	93	66	80.4	6.74	
Gainesville	102	68	82.4	4.85	
Holts	103	56	81.2	3.30	
Huntington	102	66	82.8	6.86	
Hypoluxo	90	67	81.2	1.72	
Inverness	102	68	82.4	3.09	
Johnstown	100	63	80.8	4.72	
Florida—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kissimmee	100	68	83.3	5.36	
Lake City	101	65	82.4	7.41	
Macclenny	104	67	83.8	4.50	
Malabar	98	68	81.8	3.26	
Manatee	97	66	81.0	11.66	
Marco	95	70	82.4	8.41	
Marianna	98	69	82.4	5.14	
Merritt Island	94	72	82.4	5.18	
Miami	91	69	82.9	3.28	
Molino	105	64	82.2	5.11	
New Smyrna	97	67	80.5	6.40	
Nocatee	101	68	83.0	5.19	
Ocala	102	68	82.5	8.41	
Orlando	96	70	82.8	5.43	
Pinemount	102	67	83.0	4.48	
Quincy	104	65	83.8	2.19	
Rideout	102	66	82.3	2.47	
St. Andrews	100	69	83.0	5.20	
St. Augustine	97	70	81.6	4.49	
St. Leo	102	68	82.3	3.34	
Stephensville	103	70	83.2	8.84	
Sumner	101	66	81.0	7.41	
Switzerland	100	66	81.6	3.33	
Tallahassee	96	66	81.4	5.83	
Tarpon Springs	96	67	81.6	7.30	
Titusville	96	66	81.4	6.69	
Waukeenah	104	66	83.4	2.08	
Wausau	105	67	83.2	6.23	
Wewahitchka	100	68	82.0	4.57	
Georgia.					
Adairsville	100[d]	61[d]	81.4[d]	1.18	
Albany	104	65	85.3	5.22	
Allapaha	101	65	82.2	5.38	
Allentown	105	63	82.3	6.66	
Alpharetta	99	60	80.2	1.67	
Americus	104	66	83.0	2.99	
Athens		67		3.25	
Bainbridge	102	67	83.4	3.87	
Blakely	99			4.49	
Bowersville	102	62	80.0	3.78	
Butler				5.13	
Camak	103	62	82.6	1.20	
Canton				1.43	
Carlton				1.70	
Clayton	95	54	75.2	4.57	
Columbus	101	70	85.2	4.69	
Covington	104	64	83.0	2.55	
Dahlonega	96[e]	64[e]	80.4[d]	2.17	
Diamond	97	56	75.7	2.58	
Douglas	108	65	84.2	8.00	
Dublin				6.35	
Eastman	106	64	84.6	9.02	
Elberton	104	64	81.6	3.06	
Experiment	101	62	81.8	1.54	
Fitzgerald	106	63	83.0	9.38	
Fleming	106	62	82.2	7.12	
Fort Gaines	105	69	85.4	3.48	
Gainesville	99	62	80.0	3.85	
Gillsville	99	60	80.1	2.91	
Greensboro	100	62	81.1	6.59	
Griffin	104	64	83.9	2.05	
Harrison	103	63	82.0	6.62	
Hawkinsville	105	63	82.6	7.26	
Hephzibah	108	65	85.0	2.47	
Lost Mountain	100[e]	59[e]	80.2[e]	3.79	
Louisville	102	62	82.4	7.32	
Lumpkin	106	64	82.4	4.32	
Marshallville	102	66	84.3	5.96	
Mauzy	104[m]	63[m]	83.2[m]	7.96	
Milledgeville	100	64	81.7	6.12	
Millen	107	67	84.7	6.22	
Monticello	105	63	82.8	7.93	
Morgan	100	65	81.4	3.26	
Naylor	101	68	84.6	4.43	
Newnan	102	63	82.6	3.14	
Oakdale				4.26	
Pelham				6.90	
Point Peter	105	64	81.7	2.80	
Poulan	100	62	81.2	5.65	
Putnam	105	64	83.4	5.14	
Quitman	104	66	83.2	4.62	
Ramsey	97	56	79.3	3.49	
Resaca				3.08	
Rome	103	59	82.8	2.65	
St. Marys	106	68	83.2	6.00	
Statesboro	104[d]	66[d]	83.4[d]	3.74	
Stillmore	105	64	82.3	12.29	
Talbotton	105	63	81.8	4.49	
Tallapoosa	103	58	81.4	2.15	
Thomasville	102	66	83.4	4.52	
Toccoa	101	63	80.0	3.57	
Valona	102	68	83.1	6.52	
Vidalia	104	65	83.2	4.89	
Washington	102	65	82.3	1.84	
Waverly	105	66	82.8	10.12	
Waycross	102[m]	67	82.6[g]	8.36	
Waynesboro	99	65	81.4	8.58	
Westpoint	103	65	84.3	1.32	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Georgia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Woodbury	103	58	81.6	1.76	
Idaho.					
Albion	94	29	62.4	0.43	
American Falls	98	34	65.5	T.	
Atlanta	91	29	57.1	1.69	
Blackfoot	99	37	68.2	T.	
Burnside	91	35	62.4	1.59	
Chesterfield	93	26	56.9	0.73	
Downey	95	30	62.3	T.	
Forney	92	27	55.8	1.31	
Garnet	105	44	75.2	T.	
Hailey	98	31	64.6	0.23	
Idaho City	90	32	60.4	2.00	
Lake	82	28	55.8	1.30	
Lakeview	88	41	61.6	5.38	
Lost River	95	30	63.2	0.18	
Moscow	90	37	61.0	2.33	
Murray	89	34	58.6	5.22	T.
Oakley	100	36	66.8	0.55	
Ola	101	38	66.5	1.86	
Payette	102	38	69.4	0.50	
Pollock	100	39	66.2	0.66	
Porthill	89	40	61.8	2.10	
Priest River	91	38	60.1	5.61	
Riddle	93	30	61.7	0.75	6.5
St. Maries	93	39	66.9	4.32	
Silver City	93	30	61.3	1.24	3.3
Soldier	97	29	60.7	0.47	T.
Vernon	95	29	61.1	1.42	
Weston	95	35	65.0	0.31	
Illinois.					
Albion	98	57	78.3	2.33	
Aledo	93	49	73.8	8.79	
Alexander	94	51	76.3	3.27	
Antioch	93	44	72.3	6.25	
Ashton	91	44	71.6	7.26	
Astoria	95	48	75.2	4.83	
Aurora	92	52	73.3	7.43	
Benton	102	56	80.8	1.62	
Bloomington	94	49	76.0	7.97	
Bushnell	97	48	76.4	4.50	
Cambridge	93	51	74.4	11.55	
Carlinville	95	51	77.4	1.82	
Carrollton	96	53	77.2	3.20	
Centralia	98	54	78.3	3.73	
Charleston	95	51	77.2	3.78	
Chemung	90	46	71.6	6.54	
Chester				2.62	
Cisne	100	55	78.7	1.83	
Coatsburg	97	54	77.0	3.87	
Cobden	103	58	80.4	0.82	
Danville	92	55	75.6	0.80	
Decatur	95	48	75.8	2.43	
Dixon	93	48	73.6	8.47	
Dwight	94	45	76.2	7.52	
Equality	104	54	79.4	1.69	
Flora	97	54	77.6	2.53	
Friendgrove[b5]	96	69	79.6	2.38	
Galva	92	48	73.8	10.54	
Grafton				1.30	
Greenville	99	53	78.7	2.02	
Griggsville	95	54	77.4	2.89	
Halfway	101	57	80.2	1.57	
Halliday	100	54	79.0	0.90	
Henry	92	48	74.6	11.01	
Hillsboro	96	53	77.6	1.39	
Hoopeston	97	53	76.4	4.85	
Joliet	91	45	73.4	9.38	
Kishwaukee	91	45	72.4	6.87	
Knoxville	92	45	73.4	8.07	
Lagrange	91	45	72.8	7.51	
Laharpe	95	54	75.4	6.75	
Lanark	98	44	72.3	9.79	
Lasalle	92	55	76.6	10.70	
Loami				2.38	
McLeansboro	102	57	79.8	2.21	
Martinsville	96	52	77.3	4.28	
Martinton	94	47	74.0	6.29	
Mascoutah	95	52	76.3	2.59	
Mattoon	92	48	75.4	1.26	
Minonk	94	44	73.8	7.76	
Monmouth	94	45	73.6	7.51	
Morgan Park				6.58	
Morrison	91	47	72.2	8.66	
Morrisonville	95	52	76.8	1.30	
Mount Carmel				1.65	
Mount Pulaski	95	51	76.2	3.34	
Mount Vernon	98	55	78.2	2.81	
New Burnside	102	56	81.4	2.04	
Olney	100	52	78.8	3.07	
Ottawa	96	50	76.1	10.49	
Palestine	100	55	78.0	1.63	
Pana	95	52	77.1	1.48	
Paris	94	53	76.6	4.26	
Peoria *a*				7.46	
Peoria *b*	95	54	77.4	7.30	
Philo	93	50	75.2	5.59	
Plumhill	98	56	78.0	1.88	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rantoul	96	49	76.6	5.69	
Raum	102	57	80.4	1.66	
Riley	89	47	71.2	7.78	
Robinson	95	53	76.6	2.22	
Rockford	92	51	73.5	5.76	
Rushville	95	55	77.0	4.38	
St. Charles	92	53	75.1	6.85	
St. John	102	56	79.4	3.49	
Streator	92	46	73.5	8.59	
Sullivan	96	49	76.6	2.70	
Sycamore	94	44	73.9	7.83	
Tilden	97	54	77.9	2.71	
Tiskilwa	91	53	73.2	10.70	
Tuscola	96	50	76.0	4.66	
Walnut	93	50	75.0	11.01	
Wellington	92	48	75.0	2.44	
Winchester	95	54	77.2	3.36	
Winnebago	90	48	73.1	5.85	
Yorkville	90	45	75.0	7.99	
Zion	91	48	72.8	8.70	
Indiana.					
Anderson	93	50	74.8	2.64	
Angola	91	47	71.9	3.64	
Auburn	94	46	72.2	2.57	
Bloomington	94	56	76.8	4.19	
Bluffton	96[e]	49[e]	75.7[e]	5.21	
Butlerville	95	50	75.6	3.33	
Cambridge City	93	48	73.6	1.86	
Cannelton	96	60	78.4	0.21	
Columbus	95	51	76.4	2.24	
Connersville	93	52	74.6	1.84	
Crawfordsville	98	55	78.8	2.70	
Delphi	95	49	75.2	5.16	
Edwardsville	92	61	78.8	1.76	
Farmland	92	51	74.0	1.91	
Fort Wayne	99	48	74.5	2.76	
Franklin	93	61	77.0	2.48	
Greencastle	91	55	75.6	4.42	
Greensburg	98	48	77.4	4.32	
Hammond	90	49	71.6	4.54	
Hector	96	50	75.3	2.70	
Holland	99	54	78.1	2.33	
Huntington	93	49	74.2	3.07	
Jeffersonville	97	57	78.4	1.80	
Knightstown	97	50	76.3	1.54	
Kokomo	94	52	75.4	6.30	
Lafayette	92	51	74.8	6.56	
Laporte	96	51	75.2	5.01	
Logansport	96	50	76.0	4.90	
Madison *a*	100	55	78.4	3.20	
Madison *b*				2.39	
Marengo	95	51	76.1	2.29	
Marion	95	49	75.3	6.23	
Markle	93	48	73.0	3.10	
Mauzy	94	49	74.4	2.07	
Mount Vernon	104	57	80.4	1.37	
Northfield	93	48	73.8	3.80	
Paoli	97	50	76.4	1.13	
Prairie Creek	95	55	75.3	3.33	
Princeton	98	54	77.4	2.85	
Rensselaer	95	49	75.9	6.47	
Richmond	94	48	74.1	2.24	
Rockville	92	54	74.9	2.85	
Salem	99	50	77.8	2.09	
Scottsburg	97	52	78.1	2.11	
Seymour	93	54	75.3	5.10	
Shelbyville	95[e]	55[e]	75.4[e]	2.28	
South Bend	91	47	73.6	4.16	
Syracuse	94	46	74.3	6.27	
Terre Haute	97	57	78.4	3.18	
Topeka	91	45	71.7	4.45	
Valparaiso	92	47	73.4	5.51	
Veedersburg	95[d]	50[d]	74.9[d]	2.48	
Vevay	95	56	76.5	3.75	
Vincennes	100	57	79.2	2.84	
Washington	101	54	78.1	3.57	
Winamac	93	41	72.6	5.59	
Worthington	95	54	76.8	4.61	
Indian Territory.					
Ardmore	103	63	82.2	2.33	
Chickasha	98	61	80.7	2.11	
Durant	99	63	80.6	1.83	
Fairland	94	56	77.6	2.95	
Goodwater	102	66	81.5	8.90	
Hartshorne	96	59	80.4	2.79	
Healdton	105	60	82.1	2.97	
Holdenville	96	60	78.7	0.62	
Marlow	101	62	80.5	0.76	
Muskogee	94	59	78.8	1.67	
Ryan	102	66	83.7	1.91	
South McAlester				2.00	
Tahlequah	96	56	79.0	0.52	
Tulsa				0.10	
Wagoner	98	62	83.0	2.70	
Webbers Falls				2.54	
Iowa.					
Afton	95	52	75.0	8.67	
Albia	86	51	72.2	8.82	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Algona	94	51	72.6	6.03	
Allerton	93	51	74.2	8.77	
Alta	90	49	70.2	12.24	
Amana	92	51	73.9	6.17	
Ames	94	53	72.8	8.06	
Atlantic	94	50	73.4	9.36	
Audubon	94	50	73.2	8.72	
Baxter	95	51	73.0	6.60	
Bedford	94	51	73.6	7.63	
Belknap	96	48	73.2	6.68	
Bonaparte	94	50	75.0	8.06	
Britt	92	48	72.4	6.83	
Buckingham				7.66	
Burlington	93	60	75.8	6.27	
Bussey				7.26	
Carroll	95	47	72.2	9.52	
Cedar Rapids	94	53	74.7	7.52	
Centerville	92	48	73.7	7.00	
Chariton	91	52	73.8	10.07	
Charles City	98	51	72.6	7.92	
Chester	92	46	71.4	6.21	
Clarinda	96	53	75.0	8.02	
Clearlake	96	50	73.2	9.15	
Clinton	95	41	74.2	7.79	
College Springs	93	54	74.3	9.91	
Columbus Junction	95			10.90	
Corning	92	51	73.2	8.72	
Council Bluffs	97	54	75.0	10.23	
Cresco	90	49	70.5	8.41	
Cumberland				8.99	
Danville				7.73	
Decorah	90	52	71.4	8.43	
Delaware	90	49	71.4	5.97	
Denison	93	48	71.8	11.34	
De Soto	94	56	76.1	7.86	
Dows	94	50	72.4	12.19	
Earlham	92	50	72.5	8.46	
Eldon	95	50	75.0	5.63	
Elkader	95	50	73.8	8.10	
Emerson				8.47	
Estherville	89			5.61	
Fairfield	95	50	75.4	11.40	
Fayette	92[e]	49[e]	70.2[e]	9.07	
Forest City	92	52	71.6	6.58	
Fort Dodge	94	50	72.2		
Fort Madison				7.91	
Galva	92	51	71.8	10.39	
Gilman				7.88	
Grand Meadow	90	52	70.9	10.70	
Greene	93	50	73.2	8.79	
Greenfield	90	50	72.2	10.87	
Grinnell (near)	88	53	72.1	11.57	
Grundy Center	92	50	72.2	8.74	
Guthrie Center	95	48	72.6	9.27	
Hampton	94	52	72.6	10.95	
Harlan	95	50	73.6	12.63	
Hopeville				7.89	
Humboldt	94	52	72.6	8.81	
Independence	89	50	71.0	9.51	
Indianola	92	53	73.4		
Iowa City	94	50	74.5	6.89	
Iowa Falls	92	51	71.9	11.28	
Jefferson				10.65	
Keosauqua	95	50	76.0	6.43	
Knoxville	92	52	74.6	8.23	
Lacona				8.50	
Lansing	94	52	73.0	6.87	
Larrabee	93	47	72.5	7.19	
Leclaire				7.57	
Lemars	92	46	71.6	7.08	
Lenox	91	53	72.6	7.86	
Leon	92	53	75.0	10.11	
Logan	95	49	73.4	11.34	
Maple Valley				12.37	
Maquoketa	92	45	72.8	8.80	
Marshalltown	96	52	74.3	7.69	
Monticello	92	49	74.4	7.80	
Mountayr	93	53	74.0	7.44	
Mount Pleasant	95	55	75.8	8.70	
Mount Vernon	95	51	73.9	7.20	
New Hampton	90	50	70.2	8.19	
Newton	91	52	72.4	7.91	
Northwood	89	50	70.2	8.48	
Odebolt	95	47	73.7	13.57	
Onawa	94	52	74.4	13.48	
Osage	90	49	71.1	6.31	
Osceola	91	51	73.6	10.35	
Oskaloosa	92	51	73.4	8.79	
Ottumwa	92	58	75.8	7.32	
Ovid	91	52	73.6	11.57	
Pacific Junction	94	52	75.0	9.88	
Plover	95	44	70.6	9.94	
Primghar				5.46	
Redoak	90	56	74.1	11.19	
Ridgeway	95	55	74.0	9.34	
Rockford				6.97	
Rockwell City	94	51	71.4	9.85	
Ruthven	92	48	72.0	8.80	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sac City	94	50	72.0	12.61	
St. Charles	99	53	73.8	12.77	
Scranton	96	51	74.1	11.30	
Sheldon	90	47	71.2	5.90	
Sibley	92	45	71.0	5.58	
Sigourney	97	49	75.0	11.03	
Sioux Center	90	53	71.3	5.64	
Spirit Lake	93	53	72.8	5.41	
Stockport	.....	.....	.....	9.34	
Storm Lake	90	49	70.9	10.49	
Stuart	94	53	74.5	10.34	
Thurman	94	52	75.1	8.80	
Tipton	92	50	73.0	8.90	
Villisca	93	52	74.1	10.52	
Vinton *1	91	58	73.0	8.75	
Wapello	88	52	73.5	8.11	
Washington	91	48	72.5	7.80	
Washta	.....	.....	.....	10.02	
Waterloo	94	52	72.7	10.61	
Waverly	91	53	72.0	7.07	
Westbend	93	54	72.2	8.36	
Westbranch	.....	.....	.....	7.68	
West Union	.....	.....	.....	8.42	
Whitten	93	49	73.3	8.45	
Wilton Junction	96	52	75.2	8.46	
Winterset	91	55	73.6	11.08	
Woodburn	.....	.....	.....	9.83	
Kansas.					
Achilles	104	46	73.1	3.35	
Anthony	.....	.....	.....	3.15	
Atchison	96	57	76.2	7.91	
Baker	95	53	74.4	8.18	
Beloit	97	55	77.6	3.04	
Burlington	96	54	77.6	4.30	
Clay Center	96	.....	.....	5.35	
Colby	105	45	74.8	3.26	
Columbus	94	56	77.7	2.41	
Coolidge	102	47	75.8	1.80	
Delphos	100	50	77.2	2.59	
Dresden	104	49	74.8	3.46	
Ellinwood	98	53	76.1	3.37	
Englewood	100	57	77.8	3.85	
Eureka	.....	.....	.....	3.87	
Eureka Ranch	100	49	75.9	2.27	
Fallriver	95	55	77.3	1.80	
Farnsworth	101	49	75.2	2.21	
Fort Leavenworth	97	59	79.3	6.88	
Fort Scott	98	55	78.5	3.56	
Frankfort	99	51	76.2	9.75	
Fredonia	91	56	76.4	2.93	
Garden City	103	50	76.2	0.98	
Gove *1	100	50	73.2	5.06	
Grenola	97	53	77.0	2.42	
Hanover	98	52	76.8	6.35	
Harrison	95	48	74.4	9.68	
Hays	97	51	75.2	3.84	
Horton	96	56	75.6	7.77	
Hoxie	105	47	76.4	3.05	
Hutchinson	96	52	76.4	1.14	
Independence	102	59	80.9	2.97	
Jetmore	98	51	76.8	6.36	
Lakin	103	50	78.2	0.71	
Lebanon	95	50	73.2	9.80	
Lebo	97	56	77.4	4.90	
Leoti	104	48	75.2	3.63	
Little River	96	55	76.5	5.62	
Macksville	96	52	75.8	3.18	
McPherson	97	55	78.2	2.89	
Madison	94	52	76.0	4.46	
Manhattan	98	51	78.0	5.81	
Marion	96	55	79.0	2.15	
Meade	101	55	77.3	2.06	
Medicine Lodge	101	57	79.6	2.19	
Minneapolis	95	50	76.2	2.37	
Moran	95	54	77.1	4.57	
Mounthope *1	95	65	79.0	2.73	
Ness City	102	53	78.8	7.09	
Norwich	96	56	77.6	2.78	
Oberlin	.....	.....	.....	5.43	
Olathe	92	56	75.8	9.11	
Osage City	95	58	76.4	6.35	
Oswego	94	56	77.0	3.69	
Ottawa	96	52	76.6	4.27	
Paola	.....	.....	.....	5.07	
Rome	97	58	78.1	2.74	
Salina	97	53	77.4	3.53	
Sedan	97	57	78.4	3.37	
Seneca	95	48	74.0	7.62	
Toronto	97	55	77.0	4.05	
Ulysses	105	54	79.0	0.45	
Valley Falls	93	53	75.2	5.13	
Viroqua	101	50	75.8	3.87	
Wakeeney	.....	.....	.....	4.01	
Wallace	.....	.....	.....	3.00	
Wamego *1	96	60	76.8	6.08	
Winfield	96	58	79.2	3.09	
Yates Center	95	52	77.1	4.55	
Kentucky.	°	°	°	*Ins.*	*Ins.*
Alpha	98	53	78.2	1.01	
Anchorage	96	52	76.4	1.97	
Bardstown	103	52	79.2	1.95	
Berea	99[e]	53[e]	78.1[e]	2.49	
Blandville	98	58	80.0	0.57	
Bowling Green	107	53	79.8	0.72	
Burnside	100	.....	.....	0.71	
Cadiz	107	56	80.8	2.19	
Carrollton	97	58	79.0	2.79	
Catlettsburg	98	.....	.....	4.85	
Centertown	104	51	78.3	0.91	
Earlington	101	52	78.2	0.93	
Edmonton	102	50	77.6	3.31	
Eubank	99	50	75.6	1.78	
Falmouth	.....	.....	.....	2.30	
Fords Ferry	100	51	77.6	1.08	
Frankfort	95	56	76.0	1.68	
Franklin	101	55	80.0	0.50	
Greensburg	103	53	78.4	4.27	
Henderson	102	57	80.9	1.32	
High Bridge	98	56	77.4	1.86	
Hopkinsville	101	51	80.1	0.26	
Irvington	100	54	78.6	0.92	
Jackson	96	50	73.6	1.59	
Leitchfield	99	54	77.4	0.89	
Loretto	98	48	76.5	1.38	
Manchester	97[d]	54[d]	76.6[d]	3.89	
Marrowbone	101	55	77.4	1.35	
Mayfield	102	60	81.7	0.57	
Maysville	100	54	77.0	2.59	
Mount Sterling	98	55	76.7	2.98	
Owensboro	100	56	78.8	1.18	
Owenton	94	56	76.4	4.07	
Paducah *a*	.....	.....	.....	1.94	
Paducah *b*	103	61	82.6	3.56	
Pikeville	100	57	78.2	1.73	
Richmond	96	56	76.6	3.92	
St. John	98	52	76.8	1.17	
Scott	98	54	76.2	2.58	
Shelby City	98	52	75.8	3.39	
Shelbyville	100	51	78.1	2.45	
Taylorsville	96	52	76.2	2.31	
Williamsburg	98	55	78.3	1.61	
Williamstown	99	57	78.2	1.31	
Louisiana.					
Abbeville	93	70	81.4	5.65	
Alexandria	101	68	83.4	2.12	
Amite	99	.....	.....	2.83	
Baton Rouge	96	68	83.8	2.31	
Burnside	97	69	81.7	4.97	
Calhoun	.....	62	.....	7.07	
Cameron	92	70	83.1	3.40	
Cheneyville	99	67	82.8	2.75	
Clinton	98	67	81.2	6.97	
Collinston	101	60	82.8	5.49	
Covington	99	67	83.8	5.95	
Donaldsonville	95	69	81.0	6.35	
Emilie	95	69	81.2	3.15	
Farmerville	98	61	80.2	5.77	
Franklin	97	70	82.8	4.55	
Grand Coteau	99	68	82.6	2.15	
Hammond	99	61	81.8	3.19	
Houma	101	68	83.4	4.69	
Jennings	99	67	82.0	4.59	
Lafayette	99	69	82.4	2.90	
Lake Charles	97	69	82.1	5.06	
Lake Providence	98	65	81.0	3.97	
Lakeside	98	69	82.4	2.48	
Lawreuce	98	70	83.6	3.13	
Libertyhill	102	63	82.4	6.27	
Mansfield	98	62	79.6	8.53	
Melville	97	67	81.5	1.76	
Minden	101	.....	.....	6.27	
Monroe	99	67	81.8	3.89	
New Iberia [d]	93	72	82.0	7.15	
Opelousas	98	68	81.8	3.77	
Oxford	106	61	81.2	6.58	
Paincourtville	97	69	81.2	3.12	
Plain Dealing	95	63	79.4	15.42	
Prevost	.....	.....	.....	0.70	
Rayne	102	69	83.4	3.03	
Reserve	100	69	83.1	6.20	
Robelin	100	61	81.6	5.21	
Ruddock	96	65	81.5	2.20	
Ruston	103[e]	60[e]	80.4[e]	5.74	
Schriever	100	67	82.4	3.02	
Sugar Experiment Station	97	71	84.0	1.77	
Sugartown	96	69	81.4	7.27	
Venice	95	68	81.2	3.16	
Wallace	102	67	83.0	3.82	
Maine.					
Bar Harbor	89	43	65.2	1.75	
Belfast	89	43	64.2	1.52	
Bemis	90	40	63.8	1.02	
Calais	89	45	65.6	1.37	
Carmel	87	43	65.0	4.02	
Cornish	88	48	66.0	3.24	
Fairfield	90	46	66.0	2.22	
Maine—Cont'd.	°	°	°	*Ins.*	*Ins.*
Farmington	91	42	64.4	1.93	
Fort Fairfield	87	30	62.9	2.99	
Gardiner	91	47	67.2	2.07	
Houlton	88	40	63.9	3.28	
Kineo	80	48	63.4	4.03	
Lewiston	92	48	67.0	2.02	
Mayfield	85	45	63.8	2.95	
North Bridgton	93	45	66.0	2.66	
Orono	87	43	64.2	1.81	
Patten	88	38	62.8	3.00	
Roach River	89	50	69.4	4.30	
Rumford Falls	89	44	63.8	2.31	
The Forks	.....	.....	.....	2.92	
Vanburen	93	38	64.0	3.48	
Vanceboro	90	50	68.9	2.26	
Winslow	99	44	63.8	2.62	
Maryland.					
Annapolis	98	.....	.....	2.10	
Bachmans Valley	95	51	74.5	5.34	
Boettcherville	104	49	76.4	1.80	
Boonsboro	101	52	76.3	3.13	
Cambridge	102	57	79.0	5.99	
Chase	98	50	75.6	2.51	
Cheltenham	99	55	75.5	5.06	
Chestertown	95	58	75.6	4.07	
Chewsville	99	49	74.8	3.09	
Clearspring	98	49	74.4	3.10	
Collegepark	100	54	77.0	6.21	
Colora	.....	.....	.....	4.96	
Cumberland *b*	.....	.....	.....	3.23	
Darlington	94[b]	52[b]	64.2[b]	7.29	
Deerpark	87	43	67.3	3.35	
Denton	100	53	76.3	2.41	
Easton	97	59	76.6	3.71	
Fallston	96	56	75.0	2.58	
Frederick	102	54	78.2	3.75	
Grantsville	88	43	68.8	4.19	
Greatfalls	104	53	76.2	3.26	
Greenspring Furnace	100	51	76.1	2.69	
Guard	90[a]	50[a]	71.6[a]	.....	
Hancock	101	48	75.6	2.17	
Harney	.....	.....	.....	2.83	
Jewell	95	59	76.3	4.28	
Johns Hopkins Hospital	99	60	77.4	4.04	
Laurel	101	52	76.2	2.89	
McDonogh	98	45	75.0	2.28	
Mount St. Marys College	99	60	76.5	3.02	
Newmarket	99	55	75.8	4.77	
Princess Anne	97	53	75.4	2.46	
Solomons	100	60	78.2	6.43	
Sudlersville	100[f]	54[f]	77.4[f]	.....	
Sunnyside	89	46	71.8	4.41	
Takoma Park	100	57	76.4	7.53	
Taneytown	98	54	77.0	2.75	
Van Bibber	98	58	76.2	5.75	
Westernport	96	48	73.7	2.67	
Woodstock	102	54	76.8	2.61	
Massachusetts.					
Bedford	88	52	66.4	3.11	
Bluehill (summit)	89	48	66.0	3.15	
Cambridge	95	49	68.8	3.09	
Chestnuthill	92	48	68.8	3.57	
Cohasset	.....	.....	.....	2.36	
Concord	92	46	66.1	2.78	
East Templeton *1	86	55	66.2	4.28	
Fallriver	86	51	67.6	1.72	
Fitchburg *a* *1	88	56	66.6	3.50	
Fitchburg *b*	91	47	66.8	3.42	
Framingham	92	47	68.2	2.97	
Groton	89	46	66.1	3.91	
Hyannis	.....	.....	.....	1.98	
Jefferson	.....	.....	.....	4.07	
Lawrence	90	51	67.9	5.09	
Leominster	.....	.....	.....	3.28	
Lowell *a*	90	50	69.2	3.56	
Lowell *b*	90	46	68.0	.....	
Ludlow Center	86	40	63.6	3.81	
Middleboro	89	42	66.5	2.34	
Monson	86	47	67.1	5.59	
New Bedford *a*	85	50	67.0	3.21	
Plymouth *1	87	56	66.4	1.89	
Princeton	.....	.....	.....	3.96	
Provincetown	90	52	66.6	2.04	
Salem	.....	.....	.....	2.70	
Somerset *1	94	54	71.2	2.19	
Springfield Armory	91	50	69.0	3.90	
Sterling	.....	.....	.....	4.16	
Taunton *c*	88	43	66.4	2.86	
Webster	.....	.....	.....	4.24	
Westboro	92	50	69.7	3.93	
Weston	88	44	66.1	4.28	
Williamstown	85	47	66.6	4.64	
Winchendon	.....	.....	.....	5.01	
Worcester *b*	90	50	68.2	4.29	
Michigan.					
Adrian	90	45	74.8	3.83	
Agricultural College	90	43	70.6	7.13	
Allegan	92	37	71.1	3.98	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Alma	91	45	71.4	5.75	
Ann Arbor	91	47	72.0	10.70	
Annpere	90	.....	.....	3.80	
Arbela	92	45	71.2	7.59	
Baldwin	95	40	69.4	4.17	
Ball Mountain	88	46	70.4	8.61	
Battlecreek	90	47	72.7	7.74	
Bay City	91	48	70.8	8.46	
Benzonia	87	44	68.0	3.97	
Berlin	89	45	70.3	8.29	
Berrien Springs	91	45	72.2	4.62	
Big Rapids	88	42	68.8	5.17	
Birmingham	91	47	72.3	6.45	
Boon	86	38	66.0	5.72	
Calumet	83	49	66.0	2.50	
Carsonville	90	49	71.2	.....	
Cassopolis	91	45	70.4	4.70	
Charlevoix	90	48	70.6	2.47	
Charlotte	91	45	71.5	6.49	
Chatham	88	37	64.5	3.53	
Cheboygan	89	43	68.2	2.00	
Clinton	92	45	73.3	8.87	
Coldwater	91	46	72.5	5.25	
Deerpark	88	42	62.2	1.99	
Detour	83	46	65.9	1.04	
Dundee	91	48	72.4	4.35	
Eagle Harbor	85	44	63.8	1.47	
East Tawas	98	44	67.8	6.11	
Eloise	92	48	73.0	10.67	
Ewen	90	.....	.....	.....	
Fairview	88	53	68.6	5.92	
Fennville	90	50	71.3	3.42	
Fitchburg	90	43	71.4	8.51	
Flint	90	45	71.4	6.60	
Gaylord	90	36	67.6	5.30	
Gladwin	90	40	69.6	4.65	
Grand Marais	85	44	64.7	2.46	
Grand Rapids	92	47	72.1	5.91	
Grape	92	47	72.4	3.98	
Grayling	93	41	68.9	5.00	
Hagar	92	46	73.6	5.55	
Hanover	89	45	71.1	6.48	
Harbor Beach	92	44	68.0	7.34	
Harrison	.....	43	.....	4.75	
Harrisville	94	48	67.8	6.78	
Hart	89	45	70.2	3.43	
Hastings	92	41	71.2	4.48	
Hayes	90	43	67.2	6.57	
Highland Station	.....	.....	.....	6.42	
Hillsdale	90	44	71.6	5.16	
Humboldt	87	36	65.4	3.95	
Iron Mountain	90	45	67.8	4.10	
Iron River	88	34	66.7	3.50	
Ironwood	89	48	67.8	3.33	
Ishpeming	85	42	66.3	4.37	
Ivan	86	41	66.2	5.61	
Jackson	95	47	73.4	6.60	
Jeddo	89	45	69.1	6.20	
Kalamazoo	95	51	72.7	6.23	
Lake City	91	45	70.0	3.22	
Lansing	90	49	71.6	7.28	
Lapeer	90	46	71.4	4.30	
Lincoln	91	46	69.0	4.64	
Ludington	84	45	68.2	4.95	
Mackinac Island	85	40	61.4	2.50	
Mackinaw	94	46	69.4	2.21	
Manceiona	91	41	69.0	4.03	
Manistee	90	42	69.6	9.01	
Manistique	83	44	64.2	4.48	
Menominee	91	49	68.6	4.41	
Midland	92[c]	45[c]	71.6[c]	7.06	
Mio	88	39	66.8	3.61	
Mount Clemens	97	42	73.3	5.03	
Mount Pleasant	90	43	71.0	6.47	
Muskegon	89	47	71.0	7.11	
Newberry	87	38	65.2	3.06	
North Marshall	91	45	71.4	9.50	
Old Mission	88	48	68.8	3.35	
Olivet	87	48	71.4	8.83	
Omer	.....	.....	.....	4.96	
Onaway	97	38	67.7	2.58	
Ontonagon	89	46	66.4	2.83	
Ovid	90	44	71.1	7.02	
Owosso	96	43	72.4	11.06	
Petoskey	92	46	68.8	0.92	
Port Austin	90	44	68.0	5.60	
Reed City	90	.....	.....	4.97	
Roscommon	90	36	70.8	.....	
Saginaw	92	45	72.1	6.97	
St. Ignace	87	45	66.2	3.73	
St. Johns	92	46	72.6	7.14	
St. Joseph	90	44	72.8	4.66	
Sidnaw	89	.....	.....	.....	
Somerset[c]	89	52	71.2	3.71	
South Haven	86	46	68.4	3.90	
Thomaston	87	37	64.8	2.24	
Thornville	88	47	71.8	9.09	
Traverse City	98	48	72.0	5.60	
Vans Harbor	87	43	68.6	2.66	
Vassar	90	43	71.2	4.60	
Wasepi	88	46	71.6	4.07	
Waverly	95	50	71.4	2.35	
Webberville	90	46	72.2	6.27	
West Branch	88	43	66.8	4.98	
Wetmore	92	23	65.0	.....	
Whitecloud	88	40	70.6	5.30	
Whitefish Point	79	42	62.0	2.75	
Ypsilanti	89	44	71.2	9.24	
Minnesota.					
Ada	92	46	69.0	4.63	
Albert Lea	90	51	70.8	7.49	
Alexandria	90	45	68.4	3.32	
Angus	94	43	68.0	2.04	
Ashby	93	49	68.7	2.45	
Beardsley	102	40	69.6	2.00	
Bemidji	92	49	68.4	3.75	
Bird Island	90	47	70.4	6.26	
Blooming Prairie	88	50	69.6	6.40	
Brainerd	89	47	69.6	3.12	
Caledonia	90	50	70.9	6.38	
Campbell	100	45	70.4	2.70	
Collegeville	89	54	71.4	3.08	
Crookston	92	49	68.9	2.92	
Currie	93	44	70.2	.....	
Deephaven	.....	.....	.....	6.65	
Detroit City	90	47	67.4	1.78	
Faribault	90	48	70.4	8.33	
Farmington	89	53	70.9	7.17	
Fergus Falls	96	48	70.0	1.93	
Grand Marais	.....	.....	.....	3.02	
Grand Meadow	91	49	71.2	6.79	
Hallock	90	41	66.6	4.39	
Hovland	.....	.....	.....	3.19	
Lake Winnibigoshish	92	51	68.4	3.38	
Leech	89	42	67.8	4.86	
Long Prairie	93	44	69.2	3.05	
Luverne	89	49	65.8	6.13	
Lynd	92	48	69.8	2.18	
Mapleplain	90	49	70.6	9.24	
Milaca	90[d]	46[d]	69.8[d]	4.84	
Milan	97	43	70.9	1.59	
Minneapolis *b*[1]	89*	49	70.8	5.89	
Montevideo	94	45	70.4	2.40	
Morris	93	48	69.9	6.09	
Mount Iron	89	40	65.2	4.76	
New London	94	48	71.0	3.32	
New Richland	90	50	72.0	11.98	
New Ulm	93	50	72.2	4.84	
Park Rapids	89	44	68.0	1.92	
Pine River	92	51	69.3	4.53	
Pipestone	90	49	71.4	1.34	
Pleasant Mounds	88	49	69.9	4.72	
Pokegama Falls	95	41	69.0	3.04	
Redwing *a*	.....	.....	.....	8.72	
Redwing *b*	90	54	74.6	6.45	
Reeds	.....	.....	.....	6.70	
Rolling Green	89	50	71.1	6.85	
St. Charles	94	45	70.4	5.49	
St. Cloud	92	50	70.3	4.75	
St. Peter	90	50	72.4	7.60	
Sandy Lake Dam	90	43	67.8	3.80	
Shakopee	88	53	70.4	6.51	
Tower	92	35	64.5	1.90	
Two Harbors	87	44	62.8	5.23	
Wabasha	93	50	73.0	6.43	
Willmar	91	45	64.4[g]	3.72	
Willow River	91	43	67.6	4.58	
Winnebago City	92	51	71.9	7.57	
Winona	90	51	72.0	6.67	
Worthington	88	53	70.5	5.70	
Zumbrota[1]	90*	50	71.1	.....	
Mississippi.					
Aberdeen	104	60	83.5	6.76	
Agricultural College	103	64	81.8	3.91	
Austin	94	58	79.8	3.11	
Batesville	103	58	81.4	4.58	
Bay St. Louis	96	71	84.6	2.36	
Biloxi	95	71	83.8	2.19	
Booneville	102	61	81.2	6.10	
Brookhaven	101	66	82.2	3.61	
Canton	101	60	82.6	1.72	
Columbus *a*	.....	.....	.....	4.42	
Corinth	102	59	81.0	1.11	
Crystalsprings	102*	65*	83.2[d]	4.59	
Duck Hill	104	55	82.2	3.19	
Edwards	100	64	82.6	5.55	
Fayette	98	63	82.2	1.35	
Fayette (near) *[1]	98	73	84.0	3.14	
Greenville *a*	95	66	81.6	2.13	
Greenville *b*	104	64	84.2	2.09	
Greenwood	103	58	82.3	6.09	
Hattiesburg	103	63	83.4	5.27	
Hazlehurst	101	65	83.0	3.48	
Hernando	98	62	80.6	2.39	
Holly Springs	99	64	81.6	3.60	
Indianola	102	59	81.8	2.98	
Jackson	105	63	84.4	4.13	
Kosciusko	103	61	83.6	1.44	
Lake	100	60	82.0	2.88	
Leakesville	106	65	83.8	4.42	
Louisville	100	61	82.8	3.87	
Macon	105	56	81.8	2.25	
Magnolia	99	64	81.8	5.16	
Natchez	98	68	82.6	5.25	
Nittayuma	104	64	83.9	3.21	
Okolona	106	65	85.2	4.86	
Palo Alto	103	66	83.3	3.45	
Patmos	.....	.....	.....	2.68	
Pearlington	98	57	82.2	2.21	
Pittsboro	103	56	82.6	3.58	
Pontotoc	100	60	81.4	2.69	
Port Gibson	101	63	82.9	4.88	
Ripley	102	59	80.6	6.07	
Shoccoe	.....	.....	.....	3.31	
Stonington *[1]	96	68	80.2	4.44	
Suffolk	100	65	81.4	5.87	
Swartwout	100	68	82.0	2.26	
Thornton	98	68	84.1	2.15	
Tupelo	102	63	83.6	2.23	
University	103	55	81.2	3.08	
Walnutgrove	100	64	82.4	3.28	
Watervalley	104	.....	.....	4.35	
Waynesboro	100	66	83.0	3.46	
Woodville	99	69	83.0	6.00	
Yazoo City	103	63	81.3	3.54	
Missouri.					
Appleton City	96	58	77.2	6.81	
Arthur	96	52	77.0	4.89	
Avalon	99	55	77.2	4.97	
Bethany	94	54	74.2	5.55	
Birchtree	97	60	77.2	1.82	
Boonville	.....	.....	.....	7.54	
Brunswick	95	57	76.6	7.21	
Carrollton	.....	.....	.....	5.09	
Caruthersville	100	56	80.2	0.15	
Conception	90	56	73.6	6.53	
Cowgill *[5]	96	56	78.0	8.70	
Darksville	93	56	75.8	4.20	
Dean	95	52	77.1	2.41	
Desoto	97	55	78.0	2.61	
Downing	.....	.....	.....	5.89	
Edgehill *[5]	94	58	78.2	2.07	
Edwards	95	54	76.6	6.49	
Eightmile *[3]	.....	57	72.6	4.66	
Eldon	93	54	75.6	3.09	
Fairport	.....	.....	.....	6.38	
Fayette	97	59	78.2	7.15	
Fulton	94	55	76.8	4.47	
Galena	.....	.....	.....	3.03	
Gallatin *[1]	96	58	75.3	7.51	
Glasgow	95	56	77.1	5.82	
Gorin	.....	.....	.....	3.56	
Grant City	.....	.....	.....	7.06	
Halfway	94	55	76.4	2.18	
Harrisonville	96	55	77.2	4.90	
Hazlehurst	.....	.....	.....	4.71	
Hermann	.....	.....	.....	2.92	
Houston	97	56	78.0	1.98	
Huntsville	.....	55	.....	5.59	
Ironton	97	54	76.6	3.04	
Jackson	98	55	78.8	1.70	
Jefferson City	97	51	78.4	4.97	
Joplin	93	58	78.0	3.77	
Kidder	93	54	75.6	8.84	
Koshkonong	96	59	77.4	1.47	
Lamar	95	56	78.1	2.39	
Lamonte	.....	.....	.....	7.64	
Lebanon	94	56	77.2	1.88	
Lexington	95	56	77.4	8.30	
Liberty	95	55	76.4	6.29	
Louisiana	96[c]	53[c]	76.8[c]	5.06	
Macon	96	55	77.0	3.77	
Marblehill	100	54	77.2	1.79	
Marshall	94	55	75.6	7.07	
Maryville	95	54	74.2	7.82	
Mexico	96	55	77.2	7.28	
Miami *[5]	95	58	79.2	5.23	
Monroe City	95	53	76.1	5.35	
Montreal	95	53	75.8	3.15	
Mountaingrove	95	56	76.0	1.71	
Mount Vernon	98	56	77.8	6.38	
Neosho	93	53	76.8	4.33	
Nevada	.....	.....	.....	2.65	
New Haven	96	57	78.6	2.81	
New Madrid *b*	.....	.....	.....	0.38	
New Palestine	95	56	76.7	7.37	
Oakfield	94	56	78.2	1.83	
Olden	95	58	77.1	0.96	
Oregon	93	59	75.4	10.77	
Palmyra *[5]	94	60	78.4	3.45	
Phillipsburg	.....	.....	.....	2.18	
Pine Hill	.....	.....	.....	2.13	
Poplarbluff	103	57	79.4	1.50	
Potosi (near)	95	50	75.0	2.88	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Princeton	100	56	77.8	8.08	
Richmond	93	59	77.6	7.45	
Rockport				8.17	
Rolla				3.11	
St. Charles	96[2]	59	78.2[d]	3.82	
St. Joseph				6.34	
Sedalia	95	56	77.5	7.51	
Seymour	92	54	74.4	2.85	
Shelbina				2.43	
Sikeston	100	57	78.9	0.40	
Steffenville	95	54	77.1	2.71	
Sublett	92	52	75.4	5.89	
Trenton	92	58	76.2	6.01	
Unionville	95	54	76.1	8.44	
Vichy	95	55	76.4	2.16	
Warrensburg	95	56	77.8	6.46	
Warrenton	96	55	78.2	3.02	
Wheatland				2.97	
Willowssprings	97	54	76.1	1.55	
Windsor	95	54	77.2	4.93	
Zeitonia	97	51	77.1	2.40	
Montana.					
Adel				2.66	
Anaconda	88	32	59.4	1.75	
Augusta *	87	36	59.9		
Billings	100	45	70.0		
Boulder	88	35	58.9	1.99	
Bozeman	86	34	60.8	0.87	
Butte	84	34	59.8	1.15	
Canyon Ferry	93	38	64.6	1.97	
Columbia Falls	91	34	59.3	2.52	T.
Crow Agency	97	40	69.0	0.95	
Culbertson	95	39	67.0	2.04	
Deerlodge	85	32	58.0		
Dell	91[d]	31[d]	60.4[d]	0.08	
Dillon	88	35	60.6	1.18	
Ekalaka	99[c]	42[c]	67.4[c]	1.89	
Fort Benton	92	44	64.4	1.22	
Fort Logan	85	35	56.3	1.98	
Glasgow	99	39	67.9		
Glendive	98	42	69.6	1.75	
Greatfalls	92	42	65.4	2.14	
Kipp	85	35	57.0	3.74	
Lewistown	90	36	61.0	3.60	
Livingston	97	41	65.0	0.25	
Manhattan	90	36	62.5	1.30	
Marysville	89[c]	35[c]	60.0[c]	3.36	
Ovando	90	30	54.0	3.19	
Parrot	92[c]	39[c]	65.0[c]	1.01	
Plains	92	34	60.2	4.74	
Poplar	98	44	70.2	1.18	
Ridgelawn	96	40	67.2	0.85	
St. Pauls	91	41	63.8	0.52	
St. Peter	85	31	57.0	2.53	
Springbrook	96	29	63.0	1.27	
Toston	90	38	61.3	1.41	
Townsend	94	35	62.1	1.09	
Troy	92	37	60.0	5.44	
Twin Bridges	90[c]	36[c]	60.5[c]	0.80	
Twodot	93	33	59.2	1.10	
Utica	96	34	62.5	1.84	
Yale	88	39	61.0	2.44	
Nebraska.					
Agate				2.13	
Agee *1	96	52	72.0	3.31	
Albion	90[1]	48[1]	72.2[1]	9.62	
Alliance	100	44	69.9	1.60	
Alma	100	52	75.5	7.34	
Ames	97	51	75.4	7.86	
Ansley	96	48	74.4	5.64	
Arapahoe				4.06	
Arborville *1	96	56	73.2	8.50	
Arcadia				7.88	
Ashland *a*	96	52	75.3	13.86	
Ashland *b* *1	96	50	73.6	14.51	
Ashton				8.31	
Auburn	95	52	75.2	9.88	
Aurora	95	52	73.8	5.96	
Bartley				4.00	
Beatrice	96	52	75.0	7.35	
Beaver	100	50	74.5	6.82	
Bellevue				10.24	
Benedict				9.31	
Benkleman *1	103	56	69.8	4.00	
Blair	94	52	72.2	10.27	
Bluehill *1	95	58	74.5	11.05	
Bradshaw				9.19	
Bridgeport	111	43	72.4	3.31	
Brokenbow	95	45	71.8	6.98	
Burchard				7.81	
Burwell				5.73	
Callaway	95	49	69.8	4.40	
Central City				10.16	
Chester				10.43	
Cody				0.88	
Columbus	95	50	73.4	8.40	
Crete		52		13.17	
Culbertson				4.90	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Curtis	102[2]	48[2]	73.0[2]	4.65	
Dannebrog				5.86	
Dawson	93	55	75.2	12.51	
Edgar				11.42	
Ericson				8.35	
Ewing				4.92	
Fairbury	97	49	74.4	9.33	
Fairmont	98	50	73.0	8.38	
Fort Robinson	103	42	68.5	1.88	
Franklin	97[c]	49[c]	74.4[c]	6.21	
Fremont	96	50	73.0	7.90	
Fullerton				6.69	
Geneva	95	48	73.8	9.51	
Genoa (near)	91	53	72.6	7.55	
Gering	100	43	69.4	1.71	
Gosper				5.06	
Gothenburg	99	44	71.6	4.86	
Grand Island *a*				9.37	
Grand Island *b*	99	48	73.4	10.26	
Grand Island *c*	97	50	73.6	10.44	
Greeley				7.08	
Guide Rock				10.94	
Haigler				2.20	
Hartington	91	46	71.8	3.75	
Harvard	93	48	72.5	6.73	
Hastings *1	95	60	73.2	10.62	
Hay Springs	100[c]	43[c]	68.1[c]	1.71	
Hebron	95	50	73.7	13.30	
Hickman				11.41	
Holbrook				2.90	
Holdrege	99	50	72.8	4.68	
Hooper *1	97	56	73.8	11.40	
Imperial	104	46	71.5	3.86	
Johnstown				1.05	
Kearney	104	50	75.0	8.66	
Kennedy	107	38	71.2	3.66	
Kimball	99	41	68.2	2.65	
Kirkwood *1	98[c]	55[b]	72.6[d]	3.11	
Laclede	93	50	72.1	9.06	
Lexington	99	45	70.9	6.28	
Lodgepole	100	40	68.1	2.37	
Loup	92	46	71.8	8.86	
Lynch	102	44	73.9	4.36	
Lyons				9.56	
McCook *1	102	60	75.6	6.84	
McCool				7.59	
Madison	93	47	71.4	9.62	
Madrid	102	40	73.2	3.50	
Marquette				11.05	
Mason City				5.67	
Minden *a*	94	47	71.6	7.58	
Monroe				7.13	
Nebraska City *b* *1	96	60	75.9	9.13	
Nemaha				9.21	
Nesbit	98	44	69.4	4.52	
Norfolk	94	47	73.0	8.58	
North Loup	93	43	71.8	6.75	
Oakdale	92	46	71.8	6.29	
Odell				5.10	
O'Neill	93	46	72.1	4.95	
Ord				6.52	
Osceola				8.16	
Palmer				4.20	
Palmyra *1	94	60	73.9	12.03	
Plattsmouth *a*				8.93	
Plattsmouth *b*	100	48	73.4	8.93	
Purdum	98	40	71.4	4.50	
Ravenna *a*	95	48	72.6	8.96	
Redcloud	98	53	74.5	13.52	
Republican				8.91	
Rulo				9.21	
St. Libory				6.30	
Salem				9.05	
Santee	95	49	74.0	5.31	
Schuyler				8.72	
Seward	96	50	74.2	9.65	
Smithfield				6.77	
Spragg				4.75	
Springview	97	47	72.2	2.00	
Stanton	91	47	72.5	7.31	
State Farm	97	51	75.0	11.52	
Strang *1	96	60	75.4	10.79	
Stratton				4.63	
Superior	99	50	74.4	10.45	
Syracuse				9.85	
Tablerock	95	54	75.3	7.71	
Tecumseh *b*	97	51	75.1	9.94	
Tecumseh *c*				9.95	
Tekamah	98	50	75.0	11.34	
Turlington	94	53	74.0	9.01	
Wakefield	95	47	72.1	6.13	
Wallace				1.75	
Wauneta				1.19	
Weeping Water				10.26	
Westpoint	96	49	72.6	10.79	
Wilber *1	98	54	74.4	13.57	
Willard				5.04	
Wilsonville				4.31	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Winnebago				8.88	
Wisner				9.29	
Wymore				6.31	
York	98	51	74.4	6.11	
Nevada.					
Amos	100	30	63.0	0.55	
Austin	88	31	65.6	0.48	
Battle Mountain	104	37	70.4	0.80	
Belmont	94	35	66.4	T.	
Beowawe *1	102	40	71.3	0.80	
Butler	96	41	68.5		
Candelaria	99	39	75.0	T.	
Carson City	97	34	65.0	0.06	T.
Cranes Ranch				0.84	
Elko (near)	99	34	64.8		
Ely	94	31	66.0	0.31	
Eureka	95	32	67.2	0.50	5.0
Fenelon *1	98	37	74.1	0.30	T.
Golconda *1	98	48	74.7	T.	
Halleck *1	98	36	65.0	2.00	
Hamilton	97			0.40	4.0
Hawthorne	98	45	72.6	0.00	
Humboldt	95	33	69.0	1.02	2.0
Lee				1.51	1.0
Lewers Ranch	95	35	65.8	0.20	T.
Lovelocks	101	40	75.4	0.65	
Martins	103	35	72.7	T.	
Mill City *1	100	38	71.6	0.10	1.0
Monitor Mill	92	27	62.4	0.26	
Palisade	98	35	65.0	0.96	
Palmetto	96	25	64.4	1.18	
Reno State University	96	35	67.2	0.25	
Rioville	116	49	84.4	T.	
Silverpeak	101	44	75.4	T.	
Sodaville	103	41	77.6	0.05	
Tecoma	100	31	67.3	0.09	
Toano *1	98	39	74.0	0.24	
Wabuska	100	33	70.8	T.	
Wadsworth	98	34	70.0	0.30	
Wells *1	90	38	66.3	0.76	4.4
Wood	91	32	62.8	0.40	
New Hampshire.					
Alstead	86	46	65.5	7.85	
Berlin Mills	96	32	64.0	3.69	
Bethlehem	84	44	64.0	4.28	
Brookline *1	92	58	68.5	4.05	
Chatham	87	42	63.4	3.85	
Claremont	90	42	66.7	4.01	
Concord	89	41	65.8	4.69	
Durham	89	45	66.4	3.39	
Grafton	88	37	64.0	5.29	
Hanover	88	42	65.4	3.91	
Keene	90	40	66.4	4.95	
Littleton	84	44	63.9	4.13	
Nashua	94	46	68.8	3.33	
Newton	90	44	65.4	3.68	
Peterboro	88	39	65.4	3.85	
Plymouth	92	40	66.8	3.20	
Sanbornton	86	43	64.0	4.11	
Stratford	89	42	64.6	3.14	
New Jersey.					
Asbury Park	94	57	72.4	3.59	
Barnegat	95			2.49	
Bayonne	95	56	73.9	3.06	
Belvidere	92	51	72.6	6.21	
Bergen Point	92	54	72.8	4.30	
Beverly	95	53	75.0	5.71	
Blairstown	92	49	71.9	5.96	
Bridgeton	100	56	77.0	4.54	
Camden	95	58	75.6	6.34	
Canton				3.90	
Cape May C. H.	98	56	74.8	1.83	
Charlotteburg	88	43	68.8	4.37	
Chester	92	50	70.4	9.92	
Clayton	95	55	74.6	2.95	
College Farm	95	52	73.5	3.42	
Culvers Lake				5.02	
Dover	94	47	70.6	8.51	
Egg Harbor City	95	52	73.7	4.13	
Elizabeth	95	52	73.6	4.52	
Englewood	91	52	73.4	3.79	
Flemington	95	52	74.0	6.78	
Freehold	92	53	72.5	4.00	
Friesburg	97	54	74.8	5.04	
Hanover	93	49	71.3	6.73	
Hightstown	94	55	73.8	4.70	
Imlaystown	93	56	74.8	1.87	
Indian Mills	97	51	74.2	5.08	
Lakewood	91	53	72.4	3.61	
Lambertville	92	53	73.5	5.03	
Layton	90	45	70.2	8.23	
Moorestown	92	55	73.6	7.05	
Mount Pleasant				3.68	
Newark	93	55	72.6	3.02	
New Brunswick	94	54	74.2	5.92	
New Egypt				3.65	
Newton	91	49	72.0	7.99	
Oceanic	89	56	72.4	3.79	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Paterson	98	54	73.4	2.97	
Pemberton	94	51	73.8	4.05	
Plainfield	94	51	73.2	4.71	
Rancocas				4.63	
Ringwood	94[d]	47[d]	70.1[d]	4.74	
Rivervale	93	45	71.0	3.05	
Roseland	92	47	70.7	6.16	
Salem	98	55	75.9	7.39	
Somerville	96	50	73.2	5.52	
South Orange	91	51	72.2	4.71	
Sussex	89	48	70.8	6.93	
Three Bridges				7.14	
Trenton	90	57	74.4	5.80	
Tuckerton	97	50	73.7	1.86	
Vineland	95	51	74.2	3.68	
Woodbine	95	54	73.1	2.30	
Woodstown				4.72	
New Mexico.					
Alamagordo	105	56	78.8	1.38	
Albert	98	55	75.8	1.19	
Albuquerque	95	50	75.4	1.20	
Aztec	101	42	71.8	0.10	
Bellranch				1.34	
Bluewater	99	43	70.8	T.	
Cambray				0.67	
Carlsbad	102	60	78.0	10.50	
Deming				0.91	
Dorsey	89	49	67.8	2.04	
East View	90	42	67.4	0.19	
Engle	99	54	75.2	1.34	
Espanola	99	43	71.8	0.80	
Folsom	89	38	66.4	0.96	
Fort Bayard	93	50	70.4	0.91	
Fort Stanton	95	46	66.7	2.28	
Fort Union	93	40	66.5	1.58	
Fort Wingate	91	39	67.0	0.68	
Gage				1.45	
Galisteo	93	49	69.8	1.73	
Gallinas Spring	100	50	75.6	2.52	
Horse Springs	93	40	66.6	0.92	
Las Vegas	96	41	68.6	1.91	
Las Vegas Hot Springs	91	46	67.0	1.85	
Lordsburg				0.85	
Los Lunas	102	59	78.0	0.50	
Mesilla Park	103	54	77.2	2.16	
Olio	110	45	75.6	T.	
Raton	98	42	70.8	0.08	
Roswell	96	58	75.0	5.52	
Socorro	101	52	78.0	0.96	
Strauss				0.73	
Taos	100	42	68.6	0.53	
Winsors Ranch	85	27	56.3	2.73	
Woodbury	101	49	73.5	0.48	
New York.					
Adams				5.70	
Addison	91	48	70.6	6.85	
Adirondack Lodge	79	40	60.0	7.63	
Akron				6.82	
Alden	88	50	70.2	7.03	
Angelica	95	43	68.2	12.46	
Appleton	91	49	69.4	8.26	
Arcade	86	43	67.6	10.51	
Athens	89	51	69.4	6.09	
Atlanta	87	47	68.2	10.21	
Auburn	90	50	70.7	7.48	
Avon	89	51	70.0	6.66	
Axton	86	34	63.0	4.60	
Baldwinsville	89	54	70.4	6.27	
Bedford	96	46	70.5	3.78	
Blue Mountain Lake				7.20	
Bolivar	88	42	66.8	10.87	
Bouckville	87	48	67.0	7.25	
Browns Station				5.86	
Caldwell	88	47	66.6	6.76	
Canaan Four Corners	86	45	66.0	8.47	
Canajoharie	85	46	67.2	5.73	
Canton	87	46	67.6		
Carmel	91	48	70.0	5.21	
Carvers Falls	87	47	66.4	3.95	
Cedarhill	91	48	69.0	5.71	
Cooperstown	84	47	66.2	9.17	
Cortland	88	45	68.8	10.12	
Cutchogue	89	51	69.8	2.28	
Dekalb Junction				2.72	
Easton				7.77	
Elba	88	51	68.6	9.76	
Elmira	92	51	72.6	7.84	
Fayetteville	90	50	70.1	6.99	
Franklinville	86	42	67.4	10.09	
Gabriels	85	42	63.0	3.34	
Gansevoort				6.43	
Glens Falls	89	47	69.0	6.43	
Gloversville	87	46	67.2	7.38	
Greenwich	86	46	67.6	6.67	
Griffin Corners	84	39	64.2	7.93	
Harkness	89	47	68.8	3.93	
Haskinville				9.27	
Hemlock	86	52	70.8	8.73	
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Honeymead Brook	87	47	68.6	6.74	
Humphrey	84	43	66.8	9.68	
Indian Lake	85	35	63.0	8.31	
Ithaca	88	52	69.8	6.69	
Jamestown	89	45	70.0	9.12	
Keene Valley	90	40	65.6	5.27	
King Ferry				7.81	
Liberty	84	43	64.8	6.83	
Littlefalls, City Res.	87	50	67.0	9.07	
Lockport	86	51	69.9	5.73	
Lowville	87	47	67.3	7.37	
Lyndonville				6.26	
Lyons	99	54	72.4	6.77	
Meredith	82	43	64.4	8.19	
Middletown	90	54	70.8	5.00	
Mohonk Lake	84	51	67.7	9.75	
Moira	88	48	68.3	4.61	
Newark Valley				7.70	
New Lisbon	85	41	64.8	10.08	
North Hammond	86	52	69.9	2.02	
Number Four	81	42	63.6	7.36	
Nunda				9.93	
Ogdensburg				1.58	
Old Chatham				8.89	
Oneonta	88	46	68.2	7.71	
Oxford	85	47	67.3	8.65	
Palermo				6.00	
Penn Yan	90[d]	53[d]	71.6[d]	9.04	
Perry City	89	48	68.8	9.46	
Pine City	87	43	66.5	8.80	
Plattsburg Barracks	94	50	68.8	4.30	
Port Jervis	91	48	70.6	5.44	
Primrose	96	48	72.0	5.23	
Redhook				6.70	
Richmondville	85	42	67.3	6.95	
Ridgeway	88	51	70.0	7.00	
Rome	89	50	69.2	6.82	
Romulus	88	48	69.8	9.25	
Salisbury Mills				5.09	
Saranac Lake	86	42	64.9	3.22	
Saratoga Springs	91	48	68.3	7.28	
Scottsville				6.67	
Setauket	88	52	70.2	2.41	
Shortsville	88	52	69.6	6.20	
Skaneateles				5.92	
Southampton	84	52	68.8	3.76	
South Canisteo	89	44	67.9	8.40	
South Kortright	86	40	65.4	6.36	
South Schroon	87	41	64.3	6.04	
Speer Falls	90	48	68.1	5.44	
Straits Corners	89	47	68.8	6.19	
Ticonderoga	86	52	66.6	4.86	
Volusia	85	49	68.0	8.94	
Wappingers Falls	88	49	69.5	6.56	
Warwick				6.58	
Watertown	88	51	70.4	3.48	
Waverly	91	45	71.8	7.29	
Wedgwood	87	50	68.6	9.23	
Wells	88	39	65.1	6.04	
West Berne	87	42	66.5	7.05	
West Chazy	90	47	67.2		
Westfield *b*	86	52	69.6	8.52	
Westfield *c*	88	50	70.2	8.35	
Windham	92	40	67.0	7.44	
Wolcott	90	52	69.8	7.18	
North Carolina.					
Brevard	92	51	72.7	4.13	
Brewers	98	50	75.5	1.15	
Bryson City				1.12	
Chapelhill	107	62	83.7	1.25	
Cherryville	99	58	79.6	1.25	
Cranberry	79	56	69.9	2.14	
Currituck				1.93	
Durham				1.02	
Edenton	98	65	80.6	4.31	
Fayetteville	101	61	80.4	2.50	
Flatrock	93	49	72.8	2.81	
Goldsboro	100	63	80.1	3.95	
Graham				0.89	
Greensboro	97	62	78.4	2.30	
Henderson	99	62	79.8	2.31	
Hendersonville	93	51	73.7	1.74	
Henrietta	102	58	79.2	2.90	
Highlands	86	52	69.2	5.71	
Horse Cove	90	55	72.1	5.59	
Hot Springs	93	56	76.4		
Kinston	104	60	82.6	2.69	
Lenoir	96	52	75.3	1.99	
Linville	84	44	66.2	3.67	
Littleton	100	57	78.4	2.99	
Louisburg	100	61	80.2	3.79	
Lumberton	102	64	82.1	2.63	
Marion	99	54	76.5	2.99	
Marshall				2.42	
Moncure	106	56	81.0	2.97	
Monroe	103	55	78.8	2.79	
Morganton	98	55	76.3	2.88	
Mountairy	95	53	75.8	2.42	
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Murphy				2.13	
Newbern	98	62	80.6	4.50	
Patterson	92	53	71.5	2.95	
Penelo	102	60	80.2	1.36	
Pittsboro	105	59	82.3	3.51	
Red Springs	100	59	81.0	3.13	
Reidsville	98	58	78.4	1.60	
Rockingham	103	61	80.6	2.63	
Roxboro	100	58	79.2	2.50	
Salem	97	56	78.4	3.36	
Salisbury	102[d]	60[d]	82.1[d]	1.78	
Saxon	100	52	77.4	1.50	
Selma	104	59	83.0	3.05	
Settle	97	60	79.0	2.91	
Sloan	100	59	80.2	3.75	
Soapstone Mount	98	56	77.7	2.12	
Southern Pines *a*	106	61	83.0	4.18	
Southern Pines *b*	101	62	80.4	4.21	
Southport	100[i]	68[d]	82.3[d]	1.55	
Springhope	96	65	78.1	1.55	
Tarboro	104	58	83.4	1.12	
Waynesville	90	51	71.4	3.00	
Weldon *a*	99	62	79.5	3.28	
Weldon *b*				3.38	
North Dakota.					
Amenia	96	45	66.9	5.20	
Ashley	98	40	69.1	0.73	
Berlin	98	39	66.7	1.27	
Bottineau	94	52	70.6	1.02	
Buxton	90[g]	44[g]	67.9[g]	2.38	
Churchs Ferry	91	43	66.4	2.64	
Coalharbor	100	44	69.8	2.72	
Devils Lake	90	45	68.3	0.86	
Donnybrook				4.52	
Dunseith	85	39	60.6	2.97	
Edgeley	97	45	70.4	1.56	
Ellendale	97	44	69.8	2.15	
Falconer	95	43	68.4	1.20	
Fargo	94	42	67.8	2.54	
Forman	98	44	67.0	1.32	
Fort Yates	105	40	70.2	1.28	
Fullerton	98	42	68.6	1.91	
Gallatin	92	34	64.8	2.42	
Glenullin	101	44	68.2	2.02	
Grafton	92	47	68.5	2.65	
Hamilton	91	45	68.4	3.44	
Hannaford	95	40	67.5	1.33	
Jamestown	97	42	67.9		
Langdon	86	42	63.9	1.94	
Larimore	95	42	66.8	4.38	
Lisbon	97	44	68.2	1.75	
McKinney	91	41	64.9	1.20	
Mayville	97	45	69.6	2.32	
Medora	95	43	68.4	3.34	
Melville	92[f]	42[e]	67.7[f]	1.79	
Milton	91	40[l]	64.0[f]	1.49	
Minnewaukon	92	42	67.2	0.42	
Minot	95	45	70.1	0.57	
Minto	93	41	67.0	3.41	
Napoleon	106	41	71.4	1.78	
New England	100	34	65.6	0.08	
Oakdale	95	45	68.0	2.49	
Pembina	92	44	68.0	3.36	
Portal	86	40	63.0	1.18	
Power	97	44	69.4	1.73	
Steele	93	43	68.8	3.59	
University	88	45	67.9	2.94	
Valley City	96	41	69.6	1.74	
Wahpeton	99	48	71.0	2.58	
Willow City	91	40	64.3	1.39	
Woodbridge	90	39	64.4	0.69	
Ohio.					
Akron	92	50	72.0	5.57	
Annapolis	92	50	71.8	5.85	
Atwater				4.72	
Bangorville	95	47	72.8	8.41	
Bellefontaine	92	52	73.4	3.70	
Benton Ridge	93	50	74.2	3.42	
Bethany	100	54	77.4	1.15	
Binola				5.66	
Bladensburg	94	48	72.8	4.77	
Blaine				4.93	
Bloomingburg				2.48	
Bowling Green	91	50	73.6	3.24	
Bucyrus	95	55	74.9	7.29	
Cambridge	93	50	73.4	7.87	
Camp Dennison	97	52	76.0	2.77	
Canal Dover	95	50	74.0	6.48	
Canton	93	51	73.6	4.49	
Cardington	93	46	72.2	8.67	
Cedarville				2.21	
Clarksville	93	54	75.5	2.02	
Cleveland *a*	90	51	72.6	5.82	
Cleveland *b*	92	51	72.8	4.94	
Clifton	92	48	73.2	1.83	
Coalton	98	50	74.8	3.14	
Colebrook	90	47	71.2	9.85	
Dayton *a*				3.11	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dayton *b*	97	50	75.8	3.42	
Defiance	94	44	73.1	4.41	
Delaware	94	47	73.8	3.30	
Demos	93	53	73.6	5.86	
Dunham				4.26	
Elyria	93	48	73.0	6.70	
Findlay	98	51	75.8	4.13	
Frankfort	92	51	72.8	0.70	
Fremont	94	52	74.4	4.15	
Garrettsville	91	46	71.4	6.32	
Granville	95	48	73.9	3.38	
Gratiot	93	50	73.9	3.62	
Green	96	51	75.4	3.55	
Greenfield	94	56°	75.0	1.77	
Greenhill	91	46	70.9	5.81	
Greenville	97	53	76.2	2.57	
Hanging Rock	99	55	76.1	2.74	
Hillhouse	91	43	72.0	8.75	
Hiram	89	50	72.0	7.22	
Hudson	99	46	73.0	8.60	
Jacksonboro	97	52	76.4	1.29	
Killbuck	92	49	72.6	5.66	
Lancaster	94	50	74.0	3.44	
Lima	94	50	73.2	2.81	
Logan	95	49	74.2	3.25	
McConnellsville	95	52	74.8	3.42	
Mansfield				6.90	
Marietta	93	57	75.2	3.00	
Marion	94	50	74.0	7.14	
Medina	92	47	73.4	6.84	
Milfordton	93	46	72.4	6.33	
Milligan	95	48	73.7	3.32	
Millport	91	48	72.0	5.52	
Montpelier	92	48	72.3	4.82	
Napoleon	93	50	74.3	4.70	
New Alexandria	97	52	74.4	6.50	
New Berlin	93	48	73.2	6.36	
New Bremen	94	45	71.9	3.65	
New Lexington				5.26	
New Richmond	97	55	76.6	2.99	
New Waterford	98	48	73.0	5.53	
North Royalton	90	47	72.0	7.95	
Norwalk	95	49	73.7	6.25	
Oberlin	94	48	75.6	6.65	
Ohio State University	93	49	73.6	4.43	
Orangeville	91	46	71.7	6.28	
Ottawa	94	50	73.4	3.99	
Pataskala	95	48	73.8	3.76	
Philo	97	53	76.2	5.15	
Plattsburg	97	48	75.4	2.82	
Pomeroy	99	54	76.3	2.21	
Portsmouth *a*				3.53	
Portsmouth *b*	98	58	77.3	3.48	
Pulse				2.28	
Red Lion				1.97	
Richfield				7.15	
Richwood	95	47	74.9	3.22	
Ripley	96	50	74.3	3.49	
Rittman	98	42	72.2	7.50	
Rock				5.07	
Rockyridge	94	50	74.3	5.19	
Shenandoah	93	45	72.2	7.89	
Sidney	96	50	75.4	3.49	
Springfield				5.72	
Strongsville				7.39	
Swanton				4.51	
Thurman	92	55	74.4	3.83	
Tiffin	92	53	74.4	4.90	
Upper Sandusky	95	51	75.0	7.05	
Urbana	90	50	72.3	4.38	
Vanwert	92	49	71.3	4.55	
Vickery	94	49	74.0	4.37	
Walnut				2.87	
Warren	98	48	73.8	8.09	
Warsaw	96	46	73.2	6.29	
Wauseon	95	47	74.2	6.24	
Waverly	98	53	76.1	4.53	
Waynesville	94	50	73.6	1.89	
Wellington	95	48	74.0	7.09	
Wooster	93	46	73.0	5.26	
Zanesville				5.77	
Oklahoma.					
Ames	99	62	80.8	2.28	
Arapaho	102	55	79.4	3.86	
Beaver	103	57	78.3	2.50	
Blackburn	99	57	77.9	1.22	
Burnett	99	62	80.2	1.23	
Chandler	97	61	79.6	4.76	
Clifton	99	57	80.5	1.86	
Cloud Chief	97	61	79.5	0.88	
Enid	100	60	80.1	0.80	
Fort Reno	96	62	79.8	2.58	
Fort Sill	98	58	79.3	3.25	
Guthrie	95	58	79.6	1.69	
Hennessey	99	62	80.9	0.80	
Jefferson	101	61	79.4	1.09	
Jenkins	97	59	78.3	2.32	
Kenton	100	49	75.5	1.61	
Oklahoma—Cont'd.					
Kingfisher	98	61	80.3	1.91	
Mangum	104	65	83.5	2.60	
Newkirk	100	58	79.3	1.03	
Norman	98°	60°	79.0°	1.87	
Pawhuska	103	58	81.1	1.22	
Perry	98	59	79.8	0.53	
Sac and Fox Agency	97	60	79.9	1.91	
Shawnee	97	61	79.9	1.79	
Stillwater	98	60	79.6	2.85	
Taloga	102	63	80.2	3.40	
Waukomis	98	60	80.2	2.23	
Weatherford	102	61	80.7	2.13	
Oregon.					
Albany *a*	89	48	63.0	1.71	
Albany *b*				1.98	
Alpha	94	39	61.0	1.66	
Arlington	101	47	70.2	0.40	
Ashland	101	38	65.2	1.12	
Aurora [1]	93	50	65.8	2.00	
Bay City	88	41	57.0	4.09	
Bend	97	28	57.8	0.51	
Beulah	105	32	66.1	0.18	
Blackbutte	95	40	64.3	3.52	
Blalock	106	47	73.4	0.18	
Brownsville [1]	98	50	66.2	2.51	
Bullrun				4.91	
Cascade Locks	95	43	65.0	1.51	
Comstock [1]	92	45	61.4	2.29	
Coquille				0.94	
Corvallis	96	40	63.6	1.44	
Dayville	95	38	63.5	0.69	
Detroit	100	39	62.6	3.87	
Doraville	95	42	61.4	2.43	
Ella				0.30	
Eugene	92	43	63.0	2.37	
Fairview	93°	40°	59.9°	1.81	
Falls City	93	38	60.8	1.07	
Gardiner	73	43	55.3	1.29	
Glenora	96	40	60.6	3.23	
Government Camp	87	31	52.2	5.71	4.0
Grants Pass	105	38	66.2	0.30	
Hare	81	43	57.8	1.94	
Heppner	103	40	66.9	0.47	
Hood River (near)	98	40	64.6	0.38	
Huntington	101	45	74.4	0.65	
Jacksonville	104	41	67.8	0.44	
Joseph	90	29	57.6	0.37	
Junction City [1]	98	42	66.0	1.15	
Klamath Falls	102	28	63.2	T.	
Lafayette [1]	102	50	67.9	1.66	
Lagrande	97	36	63.6	1.20	
Lakeview	100	32	64.2	0.45	
Lonerock	95	35	60.6	0.33	
McKenzie Bridge	100	37	62.6	2.80	
McMinnville	96	41	63.2	1.57	
Monmouth *a* [1]	96	49	63.4	1.18	
Monroe	93	40	63.6	1.15	
Mount Angel	92	46	64.2	1.87	
Nehalem				3.87	
Newberg	95	41	63.3	1.87	
Newport	70	44	56.5	2.51	
Pendleton	105	44	70.0	0.52	
Pine	102	29	65.2	0.60	
Placer				0.60	
Prineville	98	34	65.7	0.11	
Riddles [1]	100	45	65.7	0.55	
Riverside	105	33	67.4	0.15	
Salem [1]	98	48	65.9	1.81	
Sheridan [1]	95	50	67.4	0.55	
Silverton [1]	102	52	69.0	2.18	
Siskiyou [1]	98	42	67.2	1.03	
Sparta	95	34	63.8	0.90	
Springfield [1]	94	48	67.6	2.87	
Stafford	93	43	63.7	2.30	
The Dalles	101	43	69.7	0.26	
Toledo	96	40	60.9	2.20	
Umatilla *a*				0.07	
Umatilla *b*	106	48	73.4	0.00	
Vale	99	35	65.6	0.23	
Wamic	105	32	64.7	0.72	
Warm Spring	101	38	66.0	0.47	
Weston	99	38	63.6	2.06	
Williams	101	36	63.4	0.25	
Pennsylvania.					
Aleppo	92	47	73.4	8.55	
Altoona	94	45	71.5	6.88	
Athens	92	48	70.6	5.68	
Beaver Dam				3.61	
Bellefonte	91	50	73.0	6.83	
Brookville				7.02	
Browers Lock				3.83	
California	94	49	74.8	7.33	
Cassandra	87	44	68.8	8.42	
Clarion				10.17	
Coatesville	97	55	75.4	3.19	
Confluence				5.56	
Davis Island Dam				6.80	
Derry Station	91	45	72.4	7.28	
Pennsylvania—Cont'd.					
Doylestown				4.03	
Drifton	92	43	67.5	7.00	
Driftwood				7.33	
Duncannon				5.47	
Dushore	90	41	68.3	8.95	
Dyberry	86	44	67.1	7.27	
East Bloomsburg				4.83	
East Mauch Chunk	94	47	72.2	6.64	
Easton	91	52	73.0	4.52	
Ellwood Junction				5.70	
Emporium	88	48	70.4	12.35	
Ephrata	94	53	74.6	3.10	
Everett	93	50	72.1	2.15	
Forks of Neshaminy [1]	90	60	73.2	4.70	
Franklin	92	48	71.0	8.95	
Freeport				5.14	
Girardville				5.02	
Greensboro				7.06	
Hawthorn	95	46	71.3	8.57	
Herrs Island Dam				3.63	
Huntingdon *a*				3.77	
Huntingdon *b*	96	47	72.6	4.30	
Irwin	96	51	73.3	5.62	
Johnstown	97	49	74.6	5.19	
Keating				8.29	
Kennett Square	91	56	73.8	2.11	
Lansdale				2.68	
Lawrenceville	90	45	69.0	7.37	
Lebanon	94	50	74.0	4.21	
Leroy	87	50	69.0	9.46	
Lewisburg	90	50	72.4	6.86	
Lockhaven *a*	93	50	73.8	8.34	
Lockhaven *b*				10.90	
Lock No. 4				7.01	
Lycippus	90	50	72.5	4.79	
Mifflin				5.60	
Oil City				10.66	
Ottsville				4.53	
Parker				7.08	
Philadelphia	96	59	76.1	4.35	
Pocono Lake	85	42	66.2	6.84	
Point Pleasant				4.46	
Pottsville				6.43	
Quakertown	93	50	73.4	3.99	
Reading [2]			73.2	3.52	
Renovo *a*				8.90	
Renova *b*	90	50	71.5	7.79	
Saegerstown	92	45	70.3	9.28	
St. Marys	86	46	67.8	8.65	
Seisholtzville				3.88	
Selinsgrove	91	50	72.8	4.79	
Smethport	87	42	68.0	9.33	
Smiths Corners				5.57	
Somerset	88	42	67.5	4.74	
South Eaton	88	49	70.8	5.41	
Spring Mount				2.77	
State College	89	49	70.6	5.76	
Sunbury				6.40	
Towanda	88	48	70.2	7.77	
Troutrun				5.35	
Uniontown	90	61	75.4	6.81	
Warren	91	45	69.9	9.90	
Wellsboro	92	45	69.8	9.48	
Westchester	93	57	75.0	3.61	
West Newton				6.82	
Wilkesbarre	93	49	72.2	5.01	
Williamsport	90	52	71.9	6.02	
York	99	52	75.8	5.74	
Rhode Island.					
Bristol	78	56	67.0	2.14	
Kingston	90	48	67.0	3.23	
Providence *a*	93	55	71.1	3.41	
Providence *c*	90	50	68.4	3.94	
South Carolina.					
Aiken	104	58	79.4	4.47	
Allendale	103	67	85.0	6.66	
Anderson	105	61	81.6	4.29	
Barksdale	102	60	80.4	4.83	
Batesburg	104	60	81.2	2.39	
Beaufort	104	69	83.1	7.21	
Blackville	105	66	83.2	2.48	
Bowman	103	64	82.0	3.58	
Calhoun Falls				1.85	
Camden				3.56	
Cheraw *a*	104	62	80.8	6.87	
Cheraw *b*				6.38	
Clemson College	99	61	79.4	4.66	
Conway	104	64	82.1	1.80	
Darlington	107	64	82.9	3.14	
Duewest		63		1.86	
Edisto				4.81	
Effingham				2.74	
Florence	107	65	84.4	2.43	
Gaffney	105	60	81.6	2.28	
Gillisonville	107	68	83.2	8.02	
Greenville	96	62	77.1	3.41	
Greenwood	103	61	80.6	2.10	
Heath Springs	105	60	82.8	2.65	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kingstree *a*	100	66	80.7	5.50	
Kingstree *b*				5.57	
Liberty	104	61	80.4	3.78	
Little Mountain	105	62	82.7	3.03	
Longshore	104m	62	82.3s	2.83	
Lugoff	105	64	82.0	3.99	
St. Georges	100	67	82.3	5.57	
St. Matthews	100	65	82.0	2.96	
St. Stephens				2.26	
Saluda	104	61	82.6	1.08	
Santuck	104	59	81.0	1.69	
Seivern	106	62	82.0	3.85	
Smiths Mills				3.59	
Society Hill	100	66	82.3	3.42	
Spartanburg	101	60	79.7	3.61	
Statesburg	104	65	83.0	2.11	
Summerville	102	67	81.6	5.40	
Temperance	105	62	82.3	3.26	
Trenton	104	62	82.4	3.53	
Trial	103	63	81.6	1.89	
Walhalla	99	58	77.3	2.90	
Winnsboro	104	63	82.6	0.71	
Winthrop College	100	62	80.4	2.58	
Yemassee	103	69	83.5	9.62	
Yorkville	101	63	82.0	2.34	
South Dakota.					
Aberdeen	106	41	71.6	2.30	
Academy	106	49	74.6	1.89	
Alexandria	98	51	72.7	1.39	
Armour	102	42	72.4	3.36	
Ashcroft	99	43	68.2	2.98	
Bowdle	98	44	69.9	1.41	
Brookings	94	42	69.6	2.75	
Canton	94	46	72.0	4.39	
Centerville				5.57	
Chamberlain	107	49	74.9	0.37	
Clark	98	45	70.0	2.57	
Desmet	93	47	69.9	3.55	
Elkpoint	99	49	75.6	8.02	
Farmingdale				1.20	
Faulkton	102	48	70.8	1.58	
Flandreau	94	45	69.2	2.50	
Forestburg	101	44	71.6	1.51	
Fort Meade	106	47	72.2	1.11	
Gannvalley	108	46	74.0	1.89	
Grand River School	102	42	72.4	0.56	
Greenwood	97	54	75.0	3.60	
Hitchcock				0.93	
Hotch City	108	42	74.2	1.47	
Howard	95	40	67.3	2.33	
Howell	103	46	71.5	1.65	
Ipswich	100	44	71.3	1.80	
Kimball	101	50	72.6	1.14	
Leola	100	43	70.7	1.35	
Marion	95	48	71.8	2.16	
Mellette	102	46	70.8	2.18	
Menno	95	47	71.6	4.70	
Millbank	100	45	70.6	2.04	
Mitchell	100	47	71.6	1.50	
Oelrichs	105	42	69.8	2.10	
Pedro	102	48	73.5	2.43	
Pine Ridge	104	42	71.0	1.78	
Plankinton	99	49	73.2	1.62	
Ramsey	96	42	71.4	1.28	
Redfield	101	45	70.4	4.68	
Rochford	95	34	60.9	2.61	
Rosebud	109	50	75.0	1.44	
St. Lawrence	101	40	71.1	2.11	
Silver City				2.20	
Sioux Falls	93	50	72.2	2.76	
Sisseton Agency	98	48	69.8	2.57	
Spearfish	101	45	68.6	2.41	
Tyndall	95	40	72.8	6.20	
Vermilion	94	50	73.5	5.55	
Watertown	96	43	68.8		
Waubay	96	44	67.8	2.76	
Wentworth	97	47	71.9	1.50	
Wessington Springs	101	52	73.1	1.28	
Wolsey				2.15	
Tennessee.					
Andersonville	95	53	77.2	3.26	
Arlington	101	58	81.0	2.40	
Ashwood	98s	54s	80.1e	1.40	
Bluff City				3.38	
Bolivar	102	57	79.9	1.36	
Bristol		51		2.05	
Brownsville	97	57	79.2	0.54	
Byrdstown	99	53	77.5	1.49	
Carthage	102	57	80.5	0.53	
Clarksville	100	57	81.1	1.70	
Clinton				3.30	
Covington	97	59	80.3	0.64	
Decatur	100	54	79.0	3.93	
Dickson	101	58	79.8	1.95	
Dover	103	53	79.8	0.77	
Dyersburg	98	62	81.8	0.25	
Elizabethton	95	54	75.2	4.40	
Erasmus	94	44	73.2	2.91	
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Florence	99	55	79.4	0.19	
Franklin	99	56	80.3	0.55	
Grace *1	100	58	80.2	4.50	
Greeneville	92	52	75.0	1.64	
Harriman	97	51	77.8	2.10	
Hohenwald	102	48	76.8	1.59	
Iron City	103	55	79.2	4.06	
Isabella	96	57	77.7	1.66	
Johnsonville	103	51	79.6	2.27	
Jonesboro *1	90	63	77.0	2.22	
Kenton *b	100	56	80.3	T.	
Kingston				2.10	
Lafayette *b	101	60	79.6	1.45	
Leadvale				0.14	
Lewisburg	102	54	81.2	1.87	
Liberty	100	54	78.4	2.13	
Lynnville	99	53	79.8	3.56	
McKenzie	101	59	82.2	0.32	
McMinnville	101	52	78.6	3.15	
Maryville	102	56	79.8	2.99	
Milan	103	56	81.7	0.96	
Newport	94	59	77.4	2.83	
Nunnelly	102	52	79.4	1.72	
Oakhill	96	51	74.7	3.00	
Palmetto	102	58	81.2	2.22	
Pope	104	51	80.2	1.03	
Rogersville	93	54	76.3	1.33	
Rugby	97	47	75.2	3.08	
Savannah	102	58	81.6	2.60	
Sewanee	98	58	78.0	3.00	
Silverlake	88	47	70.0	1.95	
Springdale	94	53	75.8	3.66	
Springfield	106	52	79.9	0.10	
Tazewell				2.23	
Tellico Plains	100	55	78.2	4.68	
Tracy City	101	50	77.0	1.74	
Tullahoma	98	50	77.4	3.60	
Waynesboro	103	54	78.4	1.35	
Wildersville	95	60	79.8	2.65	
Yukon	102	56	81.6	1.56	
Texas.					
Albany	92	68	79.0	5.57	
Alvin				3.90	
Anna	100	65	81.9	2.34	
Anson				6.75	
Arthur				5.84	
Austin *a*	100	70	84.8	6.23	
Ballinger	98	67	81.2	5.98	
Bastrop	100	68	84.4	9.18	
Beaumont	108	69	86.2	6.92	
Beeville	99	72	84.6	1.90	
Bigspring	101	64	79.6	12.89	
Blanco	98	67	81.5	5.47	
Boerne *1	99	69	80.7	2.77	
Booth				4.90	
Bowie	101	67	82.0	3.14	
Brazoria	90	71	80.8	4.37	
Brenham	96	70	81.8	11.75	
Brighton	92	73	84.0	0.34	
Brownwood	101	67	82.2	4.50	
Burnet	95	55	79.4	6.59	
Camp Eagle Pass	103	71	87.6	1.02	
Childress	99	63	80.6	2.32	
Coleman	95	67	78.4	3.49	
College Station	102	68	83.9	9.30	
Colorado	103	63	81.5	14.52	
Columbia	93	71	81.6	3.00	
Comanche	99	64	80.1	4.03	
Corsicana	100	67	83.6	8.75	
Cotulla	108	68	87.8	1.75	
Cuero	100	71	85.4	1.71	
Dallas	100	63	81.8	7.00	
Danevang	98	71	83.1	2.38	
Dublin	97	66	79.4	10.55	
Estelle	100	67	82.3	5.00	
Fort Brown	97	70	84.2	0.60	
Fort Clark	102	72	83.3	2.20	
Fort Davis	93	58	73.2	4.16	
Fort McIntosh	108	69	90.6	0.25	
Fort Ringgold	104	74	88.6	0.10	
Fort Stockton				3.43	
Fredericksburg	97	66	79.9	4.10	
Gainesville	101	65	81.6	1.22	
Georgetown	101	68	82.6	8.44	
Grapevine	100	68	81.6	10.45	
Greenville	98	65	81.0	11.96	
Hale Center	97	63	75.9	4.70	
Hallettsville	96	72	83.6	2.76	
Haskell	103	65	82.0	6.80	
Hearne	100	67	82.0	15.96	
Henrietta	101	66	82.3	1.01	
Hewitt				11.68	
Hondo				1.12	
Houston	98	66	83.8	7.44	
Huntsville	95	70	82.8	11.90	
Ira	97	62	79.4	7.93	
Jacksonville	93	68	79.6	10.90	
Jasper				6.46	
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Junction				2.81	
Kaufman	102	69	84.5	10.40	
Kent				3.66	
Kerrville	98	65	79.8	2.19	
Kopperl				10.60	
Lampasas	96	68	81.4	4.50	
Laureles Ranch				0.00	
Llano *1	100	70	83.2	4.27	
Longview	98	68	82.0	7.83	
Luling	98	69	84.8	3.04	
Mann	98	68	81.4	11.00	
Menardville	101	61	81.0	2.29	
Mount Blanco	97	60	77.4	3.26	
Nacogdoches	93	66	79.8	5.77	
New Braunfels	97	71	83.6	7.89	
Panter				8.94	
Paris *a*	100	60	80.2	4.62	
Pearsall	102	69	86.8	3.64	
Port Lavaca	93	74	83.2	0.70	
Rhineland	101	66	81.4	7.74	
Rockisland	92	68	80.6	4.82	
Rockport	90	70	80.2	2.07	
Runge	101	71	85.6	5.52	
Sabine	94	69	83.0	7.99	
Sanderson	97	69	82.8	0.01	
San Marcos	99	68	84.0	14.83	
San Saba	99	64	81.6	5.33	
Santa Gertrude Ranch				0.18	
Shaeffer Ranch	101	72	85.2	0.42	
Sherman	95	68	81.9	3.31	
Sugarland	94	67	81.5	6.10	
Sulphur Springs	96	66	80.4	15.67	
Temple *b*	97	66	80.9	19.79	
Trinity	97	70	81.7	6.95	
Tyler	98	60	82.0	6.95	
Victoria	98	70	82.6	3.48	
Waco	101	71	85.1	8.95	
Waxahachie	99	66	81.1	8.75	
Weatherford	99	68	82.5	6.15	
Weimar	101	68	85.0	6.00	
Wichita Falls				0.98	
Wharton	94	72	83.2	3.44	
Utah.					
Alpine				T.	
Aneth	104	46	76.0	0.19	
Blackrock	93	34	66.6	0.40	
Bluecreek *1	97	50	77.5	0.50	
Castledale	103	29	66.6	0.15	
Cisco				0.00	
Corinne	102	40	71.5	1.00	
Coyoto	92	23	60.8	0.54	
Deseret	102	32	69.5	0.08	
Emery	86	33	60.4	T.	
Escalante	98	38	69.8	1.00	
Farmington	98	39	69.8	0.95	
Fillmore	104l	35	73.8e	0.49	
Fort Duchesne	104	38	68.8	0.05	
Frisco	96	35	71.6	0.74	
Giles	103	41	72.8	0.30	
Government Creek	99	34	70.0	0.22	
Green River	112	49	79.1	T.	
Grover	96	35	66.6	0.58	
Heber	94	30	62.4	0.15	
Henefer	93	32	61.5	0.47	
Hite	107	44	80.4	0.09	
Huntsville				0.35	
Kelton	98	37	67.4	0.00	
La Sal	92	34	66.0	0.06	
Levan	94	34	68.4	0.32	
Loa	94	19	60.1	0.00	
Logan	92	37	68.4	0.52	
Manti	95	32	66.2	0.26	
Marysvale	95	29	65.2	0.85	
Meadowville	90	31	62.2	T.	
Millville				0.46	
Minersville	97	36	70.9	0.41	
Moab	104	43	74.4	0.30	
Monticello	92	35	65.5	0.12	
Mount Nebo	100	34	71.4	0.42	
Mount Pleasant	97	33	68.6	0.38	
Oden	98	39	70.7	0.82	
Parowan	102	29	69.0	0.49	
Pinto	95	26	62.0	0.01	
Plateau	94	30	61.9	0.29	
Promontory				0.00	
Provo	100	36	69.2	0.11	
Ranch	92	25	60.3	0.05	
Richfield	94	32	65.6	0.18	
St. George	108	41	76.2	1.82	
Scipio	102	31	68.2	0.07	
Snowville	96	33	63.8	0.39	
Terrace *1	102	44	73.5		
Thistle	106	35	72.6	0.35	
Tooele	98	35	71.8	0.29	
Tropic	98	17	62.2	0.57	
Vernal	98	39	69.2	0.12	
Virgin	102	20	72.4	0.00	
Wellington	100	32	67.2	0.02	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Woodruff	94	27	59.2	0.22	
Vermont.					
Burlington	87	54	69.8	6.23	
Chelsea	84	41	64.0	3.86	
Cornwall	89	46	67.0	3.50	
Enosburg Falls	90	42	66.4	5.10	
Hartland	86	40	63.8	5.89	
Jacksonville	84	40	63.4	4.66	
Manchester	84	41	65.6	7.65	
Norwich	89	40	64.7	4.03	
St. Johnsbury	89	42	65.9	4.48	
Vernon [e]	86	57	68.2	8.01	
Wells	86	48	65.6	7.54	
Woodstock	88	38	65.8	4.61	
Virginia.					
Alexandria	101	58	78.0	3.53	
Ashland	100	57	78.2	2.75	
Bedford	101	56	79.6	2.49	
Birdsnest [2]	.....	.....	75.3	1.30	
Blacksburg	95	46	72.5	4.09	
Bonair	98	58	78.0	5.98	
Buckingham	.....	41	.....	1.54	
Burkes Garden	87	45	67.6	3.34	
Callaville	99	56	78.0	3.69	
Clarksville	.....	.....	.....	4.50	
Cliftonforge	105	46	79.6	1.90	
Columbia	108	55	78.3	1.90	
Dale Enterprise	101	48	74.7	2.73	
Danville	.....	.....	.....	1.60	
Farmville	101	60	80.7	2.62	
Fredericksburg	98	58	78.1	6.34	
Freeling	95	53	72.8	2.08	
Grahams Forge	91	45	71.4	1.48	
Hampton	97	60	79.6	6.20	
Hot Springs	95	45	70.3	1.19	
Lexington	101	52	75.8	2.45	
Lincoln	102	55	78.4	1.92	
Manassas	103	72	77.0	2.74	
Marion	91 [d]	41 [d]	71.8 [d]	0.90	
Mendota	.....	.....	.....	3.94	
Newport News	98	62	81.4	5.15	
Petersburg	101	56	79.4	3.87	
Quantico	100	54	78.0	.....	
Radford	.....	.....	.....	1.63	
Riverton	.....	.....	.....	2.49	
Roanoke	98°	54°	75.9°	2.40	
Rockymount	87	54	72.3	2.04	
Shenandoah	.....	.....	.....	1.23	
Speers Ferry	.....	.....	.....	2.63	
Spottsville	101	52	78.2	3.91	
Staunton	99	53	76.3	3.18	
Warsaw	100	52	77.9	3.22	
Wilkersons	102	55	77.6	2.56	
Williamsburg	94	54	74.8	4.78	
Woodstock	101	55	76.8	0.94	
Wytheville	94	48	73.2	3.00	
Washington.					
Aberdeen	86	40	59.0	1.33	
Anacortes	.....	.....	.....	0.58	
Ashford	.....	.....	.....	4.11	
Bremerton	95	43	62.6	1.38	
Brinnon	90	45	62.8	1.73	
Cedonia	88	40	60.4	3.06	
Centralia	100	35	62.3	1.80	
Cheney	.....	.....	.....	2.69	
Clearwater	88	41	59.3	2.51	
Cle Elum	93	34	61.4	0.88	
Colfax	94	38	61.8	2.79	
Colville	93	36	61.4	2.95	
Conconully	90	10	63.0	2.53	
Connell	.....	.....	.....	0.00	
Coupeville	89	43	60.1	0.42	
Crescent	96	40	62.4	1.73	
East Sound	86	37	60.0	1.13	
Ellensburg	92	39	63.0	0.51	
Ellensburg (near)	96	40	64.7	0.06	
Grandmound	93	38	61.2	1.72	
Granite Falls	.....	.....	.....	3.75	
Hooper	104	42	69.0	0.72	
Iiwaco	81	.....	.....	.....	
Lacenter	94	40	61.7	2.90	
Lakeside	93	47	68.5	1.74	
Lind	106	45	71.2	0.58	
Loomis	95	47	69.0	2.74	
Mayfield	97	40	61.8	2.16	
Mottinger Ranch	105	46	72.4	0.23	
Mount Pleasant	93	42	62.6	2.37	
Moxee Valley	99	39	66.3	0.64	
Olga	79	46	61.5	0.98	
Olympia	99	40	62.8	1.76	
Pasco	108	50	79.8	0.02	
Pomeroy	103	42	68.1	1.47	
Port Townsend	84	45	60.4	0.46	
Pullman	93°	42°	63.1°	2.14	
Rattlesnake Mountains	97 [f]	40 [f]	69.2 [f]	0.36	
Republic	98	32	61.5	2.56	
Rosalia	93	43	62.3	2.83	
Sedro	92	37	61.6	2.54	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Silvana [d]	92	38	59.4	0.87	
Snohomish	90	44	61.4	2.76	
Snoqualmie	97	40	63.2	2.97	
Southbend	93	40	60.6	2.63	
Sprague	.....	.....	.....	1.50	
Stampede	.....	.....	.....	2.30	
Sunnyside	97	40	67.8	0.15	
Union	95	40	62.4	0.85	
Vancouver	91	40	62.6	1.94	
Vashon	87	45	61.8	1.53	
Waterville	99	40	64.3	1.04	
Wenatchee (near)	98	40	65.6	1.16	
Whatcom	81	42	59.8	1.79	
Wilbur	95	30	61.4	0.78	
Zindel	107	.....	76.8 [b]	1.30	
West Virginia.					
Addison	95	50	73.9	2.80	
Bayard	87	47	69.0	4.00	
Beckley	92	53	73.6	2.00	
Beverly	94	48	71.6	5.44	
Bluefield	90	55	72.5	2.40	
Buckhannon	95	50	73.6	3.97	
Burlington	97	49	74.4	1.65	
Byrne	94	53	72.3	4.04	
Cairo [c]	99	52	75.7	0.21	
Camden	88	60	75.5	2.33	
Central	95	34	74.3	4.13	
Chapel	95	58	78.4	3.35	
Charleston [d]	97	57	78.6	2.78	
Creston	.....	45	.....	3.17	
Cuba	95	54	74.3	3.37	
Dayton	93	50	73.4	3.27	
Echo	104	53	76.8	2.47	
Elkhorn	95	51	73.5	2.37	
Fairmont	.....	.....	.....	5.97	
Glenville	95	55	74.3	5.52	
Grafton	92	52	72.8	4.83	
Green Sulphur	90	50	69.5	1.68	
Harpers Ferry	.....	.....	.....	5.60	
Hinton *b*	94	56	75.2	1.33	
Huntington	99	57	76.3	3.01	
Josiah	96	56	75.8	2.08	
Leonard	86	51	75.5	3.47	
Lewisburg	93	48	72.0	0.96	
Logan	102	57	78.2	3.26	
Magnolia	100 [f]	48	75.2°	3.18	
Martinsburg	102	53	75.2	4.52	
Morgantown	90	52	73.6	8.42	
Moscow	92	50	72.4	5.08	
Moundsville	93	54	74.6	5.91	
New Martinsville	98	54	76.7	4.91	
Nuttallburg	97	53	74.8	3.13	
Oceana	96	45	74.7	2.10	
Oldfields	95	47	.....	2.91	
Parsons	95	52	71.7	3.30	
Philippi	93	50	72.2	4.40	
Pickens	88	48	69.2	7.28	
Point Pleasant	97	57	77.3	1.57	
Powellton	98	54	75.9	3.27	
Princeton	89	48	71.5	3.60	
Rippon	104°	56°	78.2°	3.97	
Romney	98	51	75.8	1.98	
Rowlesburg	.....	.....	.....	5.74	
Southside	96	60	77.0	1.69	
Terra Alta	86	46	68.4	6.45	
Uppertract	96	51	71.8	2.07	
Wellsburg	89	52	72.2	4.44	
Weston *a*	.....	.....	.....	5.76	
Weston *b*	96	54	77.2	.....	
Wheeling *a*	.....	.....	.....	7.36	
Wheeling *b*	99	61	79.4	5.50	
Williamson	96	59	72.4	1.57	
Wisconsin.					
Amherst	90	45	69.4	5.92	
Antiago	91	44	69.2	0.97	
Appleton	88	50	70.2	6.37	
Ashland	.....	.....	.....	4.82	
Barron	88	45	69.4	3.65	
Beloit	87	50	70.9	9.04	
Brodhead	91	47	72.2	7.58	
Butternut	89	37	68.0	3.06	
Chilton	91	48	70.2	7.00	
Darlington	89	46	70.6	7.80	
Delvan	90	48	72.4	12.19	
Dodgeville	90	52	71.8	7.96	
Easton	93	44	71.8	4.62	
Eau Claire	89	50	71.8	5.91	
Florence	88	41	68.6	1.31	
Fond du Lac	91	49	71.6	8.74	
Grand River Locks	.....	.....	.....	9.45	
Grantsburg	89	45	70.0	5.31	
Harvey	90	50	71.2	12.03	
Hayward	88	43	69.5	5.36	
Hillsboro	91	44	70.2	6.02	
Koepenick	93	38	67.8	3.30	
Ladysmith	88	46	69.1	6.37	
Lancaster	90	49	71.0	9.20	
Madison	85	53	71.3	8.98	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Manitowoc	94	50	69.0	8.89	
Meadow Valley	93	43	70.8	6.53	
Medford	99	45	72.7	7.20	
Menasha	.....	.....	.....	6.83	
Neillsville	94	46	71.7	6.27	
New London	93	46	71.4	6.48	
Oconto	93	47	70.4	5.53	
Osceola	89	35	69.4	3.98	
Oshkosh	91	50	71.6	6.25	
Pepin	92	54	74.4	7.07	
Pine River	93	47	71.2	7.38	
Portage	90	53	71.6	6.98	
Port Washington	92	46	68.8	6.48	
Prairie du Chien *a*	95	52	73.4	8.88	
Prairie du Chien *b*	.....	.....	.....	8.26	
Prentice	87	40	67.6	4.74	
Racine	95	49	71.8	6.87	
Sheboygan	94	52	70.8	6.82	
Spooner	87	50	69.1	4.04	
Stevens Point	92	42	70.5	4.04	
Valley Junction	96	45	73.4	5.33	
Viroqua	86	49	69.4	6.00	
Watertown	90	46	70.5	9.10	
Waukesha	88	51	71.0	8.82	
Waupaca	92	46	71.4	5.30	
Wausau	91	41	68.8	4.62	
Westfield	92	52	72.2	5.24	
Whitehall	91	45	70.4	5.19	
Wyoming.					
Alcova	103	40	68.6	1.35	
Basin	107	40	74.0	0.21	
Bedford	90	27	59.2	1.08	
Border	90	29	58.8	0.24	
Buffalo	97	41	65.0	0.45	
Centennial	89	34	62.4	0.50	
Chugwater	93	37	62.9	1.30	
Evanston	88	28	57.6	1.08	
Fort Laramie	103	40	68.7	0.71	
Fort Washakie	96	35	65.6	0.40	
Fort Yellowstone	86	35	58.2	2.29	T.
Fourbear	86	32	56.6	0.70	
Griggs	99	37	65.3	0.82	
Hyattville	101	37	68.9	0.10	
Irma	99	34	65.4	0.16	
Iron Mountain	93	35	63.3	1.35	
Laramie [e]	89	33	59.8	1.49	
Leo	93	32	59.8	0.26	
Lusk	99	38	65.7	1.69	
Moore	95	37	62.2	1.96	
Parkman	90	34	63.8	0.34	
Pinebluff	101	37	66.6	1.36	
Rawlins	102	38	63.3	0.80	
Red Bank	94	35	65.3	0.70	
Rocksprings	93	33	62.2	0.34	
Saratoga	95	35	63.0	0.58	
South Pass City	85	27	54.8	0.60	
Thayne	89	29	57.5	0.99	
Thermopolis	104	39	69.6	0.28	
Porto Rico.					
Adjuntas	89	53	72.6	6.99	
Aguadilla	95	68	82.2	2.91	
Aguirre	91	69	80.6	0.72	
Arecibo	93	65	80.5	7.67	
Bayamon	97	65	81.2	5.99	
Caguas	93	59	77.2	3.62	
Canovanas	90	72	81.7	6.10	
Cayey	99	64	82.0	3.18	
Cidra	90	61	76.2	3.46	
Coamo	96	65	80.3	1.11	
Experimental Station	.....	.....	.....	6.53	
Fajardo	90	72	82.2	4.28	
Guanica	92	64	79.6	1.45	
Guayama	.....	.....	.....	1.71	
Hacienda Amisted	93	61	77.9	1.73	
Hacienda Coloso	92	62	78.0	6.10	
Hacienda Perla	87	70	79.6	9.77	
Humacao	90	76	84.0	4.30	
Isabela	90	68	80.0	1.47	
Juana Diaz	95	65	81.4	2.33	
La Isolina [f]	92	65	78.0	3.18	
Las Marias	91	64	78.6	17.42	
Manati	94	66	79.6	6.23	
Maunabo	91	73	82.4	6.09	
Mayaguez	96	65	80.0	7.62	
Morovis	95°	66	79.9°	5.95	
Ponce	92	66	80.3	0.85	
San German	96	68	82.4	4.72	
San Salvador	91	59	75.4	6.71	
Santa Isabel	91	69	80.8	0.50	
Utuado	96	64	80.6	6.86	
Vieques	90	75	82.6	2.70	
Mexico.					
Coatzacoalcos	89	65	79.2	20.73	
Vera Cruz	89	77	80.4	.....	
New Brunswick.					
St. John	77	48	61.9	2.19	
Isthmus of Panama.					
Alhajuela	94	73	81.0	12.80	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Isthmus of Panama—Con.	°	°	°	*Ins.*	*Ins.*
La Boca	90	72	80.6	5.35	
Late reports for June, 1902.					
Alaska.					
Kenai	79	29	53.7	0.59	
Nushagak	81	35	57.2	0.40	
Point Barrow	60	29	39.6	0.46	
Teller	78	21	47.3	0.10	
Tyoonok	80	39	58.0	0.00	
California.					
Mills College				0.00	
Indiana.					
Holland	99	46	72.2	5.50	
Iowa.					
Primghar				2.10	
Michigan.					
Mio	82	35	57.2	3.01	
New York.	°	°	°	*Ins.*	*Ins.*
Adams Center				6.47	
North Carolina.					
Brewers	96	42	69.9	7.87	
Horse Cove	87	50	69.4	6.20	
Marshall				7.49	

EXPLANATION OF SIGNS.

[a] Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "[n]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

June, 1902, Indiana, Shelbyville, make mean temperature 71.5° instead of 73.0°.

Page 334, under head of "Late reports for May, 1902," strike out all values for Mills College, California, and Adams Center, N. Y.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of July, 1902.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	21	19	8	28	n. 84 w.	20
Portland, Me	14	29	11	20	s. 31 w.	18
Northfield, Vt	18	38	3	6	s. 9 w.	20
Boston, Mass	16	14	21	25	n. 63 w.	4
Nantucket, Mass	16	25	16	24	s. 42 w.	12
Block Island, R. I	11	23	20	26	s. 27 w.	13
New Haven, Conn	19	26	12	18	s. 41 w.	9
Middle Atlantic States.						
Albany, N. Y	11	34	10	18	s. 19 w.	24
Binghamton, N. Y.†	7	8	5	13	s. 83 w.	8
New York, N. Y	15	21	18	23	s. 40 w.	8
Harrisburg, Pa.†	9	8	10	14	n. 76 w.	4
Philadelphia, Pa	16	23	15	24	s. 52 w.	11
Scranton, Pa	18	25	8	27	s. 70 w.	20
Atlantic City, N. J	12	27	13	25	s. 39 w.	19
Cape May, N. J	12	30	14	17	s. 9 w.	18
Baltimore, Md	15	22	12	26	s. 63 w.	16
Washington, D. C	11	33	15	13	s. 5 e.	22
Lynchburg, Va	16	15	18	29	n. 85 w.	11
Norfolk, Va	16	32	18	11	s. 24 e.	18
Richmond, Va	14	28	16	18	s. 8 w.	14
South Atlantic States.						
Charlotte, N. C	16	20	26	18	s. 63 e.	9
Hatteras, N. C	14	23	22	20	s. 13 e.	9
Kitty Hawk, N. C.†	7	12	9	12	s. 31 w.	6
Raleigh, N. C	20	22	12	22	s. 79 w.	10
Wilmington, N. C	12	26	17	22	s. 20 w.	15
Charleston, S. C	9	23	15	23	s. 30 w.	16
Columbia, S. C	16	25	19	20	s. 6 w.	9
Augusta, Ga	16	24	15	21	s. 37 w.	10
Savannah, Ga	11	19	15	32	s. 65 w.	19
Jacksonville, Fla	4	38	18	18	s.	34
Florida Peninsula.						
Jupiter, Fla	10	31	23	15	s. 21 e.	22
Key West, Fla	7	8	44	0	s. 89 e.	44
Tampa, Fla	12	17	28	21	s. 54 e.	9
Eastern Gulf States.						
Atlanta, Ga	19	12	18	21	n. 23 w.	8
Macon, Ga.†	8	11	8	10	s. 34 w.	4
Pensacola, Fla.†	19	3	7	8	n. 3 w.	16
Mobile, Ala	22	20	11	25	n. 63 w.	4
Montgomery, Ala	9	26	13	26	s. 38 w.	22
Meridian, Miss†	5	15	2	16	s. 54 w.	17
Vicksburg, Miss	13	29	16	15	s. 3 e.	16
New Orleans, La	12	31	15	18	s. 9 w.	19
Western Gulf States.						
Shreveport, La	10	35	23	7	s. 33 e.	30
Fort Smith, Ark	10	24	30	6	s. 60 e.	28
Little Rock, Ark	12	32	14	18	s. 11 w.	20
Corpus Christi, Tex	0	45	57	0	s. 39 e.	58
Fort Worth, Tex	6	43	17	6	s. 16 e.	39
Galveston, Tex	5	42	24	7	s. 24 e.	41
Palestine, Tex	7	36	28	7	s. 36 e.	36
San Antonio, Tex	4	34	44	1	s. 55 e.	52
Taylor, Tex †	2	24	8	2	s. 15 e.	23
Ohio Valley and Tennessee.						
Chattanooga, Tenn	15	17	21	21	s.	2
Knoxville, Tenn	31	18	6	18	n. 28 w.	26
Memphis, Tenn	18	22	10	27	s. 77 w.	18
Nashville, Tenn	22	19	13	23	n. 73 w.	10
Lexington, Ky. †	5	16	7	11	s. 20 w.	12
Louisville, Ky	18	28	11	15	s. 22 w.	11
Evansville, Ind.†	5	20	7	4	s. 11 e.	15
Indianapolis, Ind	20	29	5	17	s. 53 w.	15
Cincinnati, Ohio	12	23	17	27	s. 42 w.	15
Columbus, Ohio	16	25	7	28	s. 67 w.	23
Pittsburg, Pa	22	14	9	33	n. 72 w.	25
Parkersburg, W. Va	15	29	9	24	s. 47 w.	20
Elkins, W. Va	16	21	7	30	s. 78 w.	24
Lower Lake Region.						
Buffalo, N. Y	12	24	14	29	s. 51 w.	19
Oswego, N. Y	11	30	10	23	s. 34 w.	23
Rochester, N. Y	14	21	12	30	s. 69 w.	19
Erie, Pa	16	18	7	31	s. 85 w.	24
Cleveland, Ohio	17	29	8	19	s. 43 w.	16
Sandusky, Ohio†	4	14	3	18	s. 56 w.	18
Toledo, Ohio	9	25	10	34	s. 56 w.	29
Detroit, Mich	14	23	10	30	s. 66 w.	22
Upper Lake Region.						
Alpena, Mich	20	21	17	20	s. 72 w.	3
Escanaba, Mich	19	28	10	17	s. 38 w.	11
Grand Haven, Mich	10	30	7	27	s. 45 w.	28
Houghton, Mich.†	7	3	12	16	n. 45 w.	6
Marquette, Mich	18	21	16	23	s. 67 w.	8
Port Huron, Mich	15	25	12	25	s. 52 w.	16
Sault Ste. Marie, Mich	10	17	11	33	s. 72 w.	23
Chicago, Ill	13	23	16	25	s. 42 w.	14
Milwaukee, Wis	10	23	10	32	s. 60 w.	26
Green Bay, Wis	10	33	15	24	s. 21 w.	25
Duluth, Minn	28	12	20	23	n. 11 w.	16
North Dakota.						
Moorhead, Minn	18	27	17	18	s. 6 w.	9
Bismarck, N. Dak	24	13	21	19	n. 10 e.	11
Williston, N. Dak	27	16	15	15	n.	11
Upper Mississippi Valley.						
St. Paul, Minn	17	31	13	17	s. 16 w.	15
La Crosse, Wis. †	4	24	3	2	s. 3 e.	20
Davenport, Iowa	17	30	11	18	s. 28 w.	15
Des Moines, Iowa	11	30	15	19	s. 12 w.	19
Dubuque, Iowa	16	33	11	17	s. 19 w.	18
Keokuk, Iowa	13	32	8	29	s. 48 w.	28
Cairo, Ill	12	34	10	21	s. 26 w.	25
Springfield, Ill	9	29	8	34	s. 52 w.	33
Hannibal, Mo. †	5	20	3	11	s. 28 w.	17
St. Louis, Mo	9	40	7	18	s. 20 w.	33
Missouri Valley.						
Columbia, Mo. *	3	19	9	8	s. 3 e.	16
Kansas City, Mo	11	41	10	10	s.	30
Springfield, Mo	8	42	12	10	s. 4 e.	32
Lincoln, Nebr	12	36	14	7	s. 16 e.	25
Omaha, Nebr	14	32	13	14	s. 3 w.	18
Valentine, Nebr	17	26	14	15	s. 6 w.	9
Sioux City, Iowa †	9	16	8	3	s. 36 e.	9
Pierre, S. Dak	19	22	24	14	s. 73 e.	10
Huron, S. Dak	18	29	19	6	s. 50 e.	17
Yankton, S. Dak. †	7	15	8	7	s. 7 e.	8
Northern Slope.						
Havre, Mont	17	14	12	33	n. 82 w.	21
Miles City, Mont	15	13	21	19	n. 45 e.	3
Helena, Mont	7	24	6	39	s. 62 w.	37
Kalispell, Mont	9	18	14	34	s. 66 w.	22
Rapid City, S. Dak	15	17	20	27	s. 74 w.	7
Cheyenne, Wyo	19	19	12	25	w.	13
Lander, Wyo	13	22	12	29	s. 38 w.	11
North Platte, Nebr	11	25	27	14	s. 4 e.	19
Middle Slope.						
Denver, Colo	16	25	17	23	s. 34 w.	11
Pueblo, Colo	29	11	20	17	n. 9 e.	18
Concordia, Kans	8	40	13	6	s. 12 w.	33
Dodge, Kans	7	35	36	3	s. 49 e.	43
Wichita, Kans	9	42	15	4	s. 18 e.	35
Oklahoma, Okla	7	41	19	6	s. 21 e.	36
Southern Slope.						
Abilene, Texas	13	32	34	5	s. 57 e.	35
Amarillo, Tex	4	47	12	9	s. 4 e.	43
Southern Plateau.						
El Paso, Texas	19	10	30	18	n. 53 e.	15
Santa Fe, N. Mex	12	22	30	11	s. 62 e.	22
Flagstaff, Ariz	24	17	7	28	n. 72 w.	22
Phoenix, Ariz	12	13	22	26	s. 76 w.	4
Yuma, Ariz	8	25	14	28	s. 39 w.	22
Independence, Cal	17	27	16	25	s. 42 w.	14
Middle Plateau.						
Carson City, Nev	13	18	2	41	s. 83 w.	39
Winnemucca, Nev	20	19	14	28	n. 86 w.	14
Modena, Utah	6	23	8	41	s. 62 w.	37
Salt Lake City, Utah	21	18	26	16	n. 73 e.	10
Grand Junction, Colo	15	20	28	18	s. 63 e.	11
Northern Plateau.						
Baker City, Oreg	26	25	7	17	n. 84 w.	10
Boise, Idaho	21	18	16	25	n. 72 w.	10
Lewiston, Idaho †	1	3	26	2	s. 85 e.	24
Pocatello, Idaho	7	25	20	27	s. 21 w.	19
Spokane, Wash	11	31	16	18	s. 6 w.	26
Walla Walla, Wash	10	33	6	21	s. 33 w.	28
North Pacific Coast Region.						
Neah Bay, Wash	8	27	5	42	s. 63 w.	42
Port Crescent, Wash. *	1	1	4	26	w.	22
Seattle, Wash	24	14	16	15	n. 6 e.	10
Tacoma, Wash	26	16	4	27	n. 67 w.	25
Astoria, Oreg	28	11	5	38	n. 62 w.	37
Portland, Oreg	23	20	6	32	n. 83 w.	26
Roseburg, Oreg	34	6	18	12	n. 12 e.	29
Middle Pacific Coast Region.						
Eureka, Cal	23	20	5	28	n. 83 w.	23
Mount Tamalpais, Cal	26	8	1	46	n. 68 w.	48
Red Bluff, Cal	32	19	17	5	n. 43 e.	18
Sacramento, Cal	8	43	17	8	s. 14 e.	36
San Francisco, Cal	1	14	0	55	s. 76 w.	56
South Pacific Coast Region.						
Fresno, Cal	37	4	1	42	n. 51 w.	53
Los Angeles, Cal	6	15	9	43	s. 75 w.	35
San Diego, Cal	24	15	3	33	n. 73 w.	31
San Luis Obispo, Cal	19	13	3	27	n. 76 w.	25
West Indies.						
Bridgetown, Barbados	11	4	55	0	n. 83 e.	56
Cienfuegos, Cuba	22	5	44	4	n. 67 e.	43
Grand Turk, Turks Island	0	4	29	0	s. 82 e.	29
Havana, Cuba	12	4	56	0	n. 82 e.	56
Kingston, Jamaica	49	0	23	0	n. 25 e.	54
Puerto Principe, Cuba	15	5	51	1	n. 79 e.	51
San Juan, Porto Rico	0	6	59	0	s. 84 e.	60
Santiago de Cuba, Cuba	43	11	11	7	n. 7 e.	32

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, July, 1902.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.	3	2	6	6	8	1	3	3	4	12	4	4	4	4	2	....	....	....	3	11	5	1	3	....	1	4	5	3	9	5	1	117	27	T.
		A.																																0	0	A.
Arizona	56	T.	1	....	....	....	....	....	....	....	....	4	5	4	5	6	10	10	1	2	2	4	8	7	6	7	1	....	....	....	....	....	1	84	18	T.
		A.																																0	0	A.
Arkansas	57	T.	....	1	2	5	....	2	....	1	4	....	....	....	....	7	3	1	7	4	11	4	1	3	1	6	4	1	4	20	11	9	4	116	24	T.
		A.																																0	0	A.
California	167	T.	....	1	1	....	....	....	....	....	....	2	....	....	....	....	2	....	....	....	....	....	....	....	4	4	4	1	2	....	....	....	....	1	22	10	T.
		A.																																0	0	A.
Colorado	81	T.	1	1	....	1	4	....	....	1	2	3	2	1	1	....	1	1	4	5	1	....	2	....	1	....	1	4	1	....	1	....	1	40	22	T.
		A.																																0	0	A.
Connecticut	21	T.	....	....	2	1	5	1	....	....	....	....	....	....	....	1	13	1	15	1	4	10	13	14	4	....	1	....	....	10	12	2	....	110	18	T.
		A.																																0	0	A.
Delaware	5	T.	....	....	4	1	3	3	....	....	....	....	....	....	....	....	2	....	2	3	1	5	5	2	....	1	....	....	....	2	2	1	....	37	15	T.
		A.																																0	0	A.
Dist. of Columbia	4	T.	....	....	1	1	1	....	....	1	1	1	....	....	....	....	....	....	....	1	1	1	1	....	....	1	1	1	....	....	1	....	....	14	14	T.
		A.																																0	0	A.
Florida	47	T.	3	4	6	6	7	10	14	9	4	....	12	13	12	14	12	11	11	7	13	20	17	16	15	10	8	12	14	9	9	12	11	321	30	T.
		A.																																0	0	A.
Georgia	55	T.	1	14	8	7	1	6	13	8	4	10	16	15	8	16	5	1	2	2	5	10	8	2	2	13	....	7	2	5	3	5	4	203	30	T.
		A.																																0	0	A.
Idaho	34	T.	2	2	1	1	....	....	....	....	....	2	1	2	....	....	1	.	1	....	....	....	....	....	....	1	1	1	....	....	....	3	2	21	14	T.
		A.																								1	1						4	4	A.
Illinois	92	T.	7	18	11	....	1	8	16	20	26	....	....	....	11	19	5	24	20	35	20	4	....	11	9	5	16	12	24	16	2	1	24	365	26	T.
		A.													1																			1	1	A.
Indiana	58	T.	2	5	4	....	1	5	16	4	16	1	....	1	1	2	3	13	5	27	22	5	....	1	9	4	5	4	12	22	1	....	12	203	27	T.
		A.																																0	0	A.
Indian Territory	11	T.	....	....	....	....	....	....	1	....	3	2	....	....	....	2	1	1	1	....	....	....	....	....	....	2	1	....	1	2	....	....	....	17	11	T.
		A.																																0	0	A.
Iowa	149	T.	12	33	23	6	18	27	14	33	25	1	2	10	7	20	1	8	35	20	9	4	5	5	7	11	22	16	7	....	1	13	5	400	30	T.
		A.																																0	0	A.
Kansas	77	T.	9	5	....	1	4	10	9	3	7	1	....	....	1	2	1	....	4	9	4	1	7	6	....	3	1	3	7	....	2	....	1	101	24	T.
		A.																																0	0	A.
Kentucky	41	T.	3	1	1	3	3	5	7	4	2	3	1	1	....	2	4	4	6	7	12	4	1	1	....	....	1	1	2	12	8	5	5	109	28	T.
		A.																																0	0	A.
Louisiana	46	T.	2	5	4	6	4	9	3	5	13	11	9	7	10	12	12	6	8	11	10	11	7	7	9	5	1	2	3	11	10	7	4	224	31	T.
		A.																																0	0	A.
Maine	19	T.	1	....	....	....	....	....	....	3	1	....	....	....	....	2	20	3	5	....	....	....	....	....	....	....	....	....	1	1	....	....	....	37	9	T.
		A.																																0	0	A.
Maryland	48	T.	....	....	18	16	13	20	7	7	12	9	....	....	....	....	9	....	....	19	14	16	7	1	....	12	9	....	1	1	7	5	....	203	20	T.
		A.																																0	0	A.
Massachusetts	48	T.	....	....	....	....	....	....	....	2	....	1	....	....	....	3	31	2	18	1	....	17	10	17	3	1	....	....	....	2	6	....	....	114	14	T.
		A.																																0	0	A.
Michigan	106	T.	6	19	17	20	5	4	22	9	12	1	. .	2	2	28	3	8	14	11	5	22	6	23	15	13	18	24	17	10	4	9	18	367	30	T.
		A.																																0	0	A.
Minnesota	67	T.	1	3	2	27	27	13	3	13	....	....	11	14	11	3	7	13	1	2	5	15	7	10	1	21	22	2	3	4	14	18	4	277	29	T.
		A.																																0	0	A.
Mississippi	44	T.	1	3	2	3	7	6	2	12	19	15	11	7	5	15	8	2	7	5	13	14	2	3	3	3	4	10	8	12	13	17	11	243	31	T.
		A.																																0	0	A.
Missouri	95	T.	43	15	2	....	2	....	35	22	30	....	....	....	1	8	6	2	19	38	32	1	....	21	10	16	15	17	32	22	2	5	24	420	25	T.
		A.																																0	0	A.
Montana	40	T.	5	3	6	....	....	....	....	....	....	4	6	3	3	....	....	1	....	5	....	....	9	1	1	....	....	....	1	....	1	....	....	49	14	T.
		A.																																0	0	A.
Nebraska	142	T.	23	17	3	21	34	14	29	23	21	....	1	10	24	14	....	1	35	14	13	1	11	13	9	14	23	19	9	3	7	24	8	438	29	T.
		A.																																0	0	A.
Nevada	40	T.	1	1	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	2	1	1	....	1	2	2	1	....	....	....	....	14	11	T.
		A.																																0	0	A.
New Hampshire	19	T.	....	....	....	....	....	....	....	....	....	....	....	....	11	17	....	7	....	1	1	....	1	....	2	....	....	....	....	....	....	....	....	40	7	T.
		A.																			1													1	1	A.
New Jersey	51	T.	....	....	11	....	23	3	....	3	4	4	....	. .	....	....	23	3	20	13	12	19	24	7	1	24	24	....	1	11	25	9	2	266	22	T.
		A.																																0	0	A.
New Mexico	31	T.	....	....	....	....	....	....	1	4	6	6	6	6	5	3	1	6	7	3	5	13	3	3	3	4	5	4	3	2	....	1	6	106	24	T.
		A.																																0	0	A.
New York	99	T.	1	....	2	8	39	21	24	12	18	4	....	1	1	17	44	3	37	9	13	26	7	....	16	45	5	5	31	23	6	7	15	440	28	T.
		A.																																0	0	A.
North Carolina	56	T.	1	1	5	5	9	5	13	16	10	22	7	3	....	6	7	....	....	4	5	16	13	3	1	9	3	1	5	7	17	11	8	213	28	T.
		A.																																0	0	A.
North Dakota	48	T.	1	1	4	1	2	3	....	1	....	....	1	....	3	1	1	....	....	1	3	....	....	....	1	6	5	1	3	6	3	....	2	50	21	T.
		A.							1	....	1	1	....	....	....	1	....	....	....	....	1	....	....	....	....	....	1	....	....	1	....	1	....	8	8	A.
Ohio	128	T.	1	18	35	22	5	17	23	22	36	18	....	....	....	8	13	7	2	50	40	22	7	1	4	8	8	2	26	37	18	....	12	462	27	T.
		A.																																0	0	A.
Oklahoma	23	T.	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	3	6	....	....	....	2	....	5	1	....	1	4	....	....	....	26	8	T.
		A.								1	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	4	4	A.
Oregon	74	T.	1	....	....	....	....	....	....	....	....	3	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	2	18	5	T.
		A.																																0	0	A.
Pennsylvania	91	T.	2	....	26	12	26	26	11	17	28	6	1	....	....	....	13	1	24	23	29	25	12	15	2	31	26	6	5	15	22	8	7	419	27	T.
		A.																																0	0	A.
Rhode Island	7	T.	....	....	....	....	2	....	....	1	....	....	....	....	....	....	5	1	2	....	1	2	3	1	....	....	....	....	....	....	2	....	....	20	10	T.
		A.																																0	0	A.
South Carolina	46	T.	2	2	6	7	10	8	16	13	8	16	12	8	8	6	8	2	1	1	3	11	12	4	9	12	3	4	6	11	3	11	9	232	31	T.
		A.																																0	0	A.
South Dakota	56	T.	4	5	6	12	5	7	....	15	3	1	....	11	9	9	....	....	....	4	3	6	3	....	....	6	1	8	2	....	5	3	10	4	142	24	T.
		A.																				1												1	1	A.
Tennessee	56	T.	1	8	1	5	5	4	7	5	11	17	3	3	1	7	....	2	1	3	5	9	....	1	1	2	1	4	3	11	16	6	6	149	29	T.
		A.																																0	0	A.
Texas	95	T.	....	1	8	....	1	2	10	8	1	12	17	16	6	7	9	1	1	2	5	13	15	10	12	9	11	11	10	13	13	10	7	241	29	T.
		A.																	1															1	1	A.
Utah	47	T.	8	3	4	12	3	1	...	...	...	1	....	....	....	....	2	8	10	....	....	....	....	3	1	1	7	5	2	....	....	....	....	71	16	T.
		A.																																0	0	A.
Vermont	16	T.	....	....	....	....	....	....	....	1	....	....	....	....	....	8	9	3	6	1	1	1	4	1	....	5	....	....	....	....	....	....	3	43	12	T.
		A.																																0	0	A.
Virginia	50	T.	3	...	2	13	4	14	9	14	3	10	1	....	1	2	6	....	....	11	17	17	5	....	....	5	8	7	....	1	17	10	5	185	24	T.
		A.																																0	0	A.
Washington	64	T.	3	....	....	....	....	....	....	....	....	1	....	....	1	6	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	16	7	35	7	T.
		A.																																0	0	A.
West Virginia	43	T.	1	....	10	9	5	17	14	23	8	13	....	3	2	1	1	....	....	8	23	15	5	1	....	....	3	2	2	12	14	12	8	212	25	T.
		A.																																0	0	A.
Wisconsin	60	T.	....	10	2	8	8	8	5	5	....	....	1	2	4	12	2	7	1	....	....	2	2	16	10	11	20	6	2	....	4	17	6	171	25	T.
		A.																																0	0	A.
Wyoming	31	T.	4	2	1	1	....	....	1	3	....	2	1	1	2	....	....	2	5	5	1	2	4	5	1	....	5	3	2	1	3	2	....	59	24	T.
		A.																																0	0	A.
Sums	2,893	T.	160	204	247	248	295	280	328	346	346	219	131	148	149	286	323	160	352	372	370	377	251	244	181	333	301	207	258	327	292	281	250	8,266	....	T.
		A.	0	0	0	0	0	0	1	1	1	1	0	0	1	1	1	0	1	0	2	2	0	1	0	1	2	0	1	1	0	2	0	20	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during July, 1902, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y	21	2:30 p. m.	3:50 p. m.	0.82	3:05 p. m.	3:25 p. m.	0.02	0.09	0.43	0.67	0.77	0.78	.....	.....	.....	.....	.....	.....	.....	.....	.....
Alpena, Mich	16-17	11:40 p. m.	D. N.	0.82	11:45 p. m.	11:58 p. m.	T.	0.07	0.66	0.82	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	26	8:11 p. m.	9:40 p. m.	0.84	8:15 p. m.	8:35 p. m.	T.	0.14	0.40	0.65	0.74	0.76	.....	.....	.....	.....	.....	.....	.....	.....	.....
Atlanta, Ga	2	5:32 p. m.	8:04 p. m.	1.29	5:33 p. m.	6:15 p. m.	T.	0.16	0.36	0.49	0.68	0.82	0.95	1.08	1.19	1.25	1.28	.....	.....	.....	.....
Atlantic City, N. J	3	5:35 p. m.	7:30 p. m.	1.46	5:35 p. m.	6:30 p. m.	0.00	0.16	0.26	0.28	0.39	0.46	0.51	0.68	0.93	1.24	1.34	1.42	.....	.....	.....
Augusta, Ga	28	.....	.....	0.25	.....	.....	.....	.....	.....	.....	.....	.....	0.25	.....	.....	.....	.....	.....	.....	.....	.....
Baltimore, Md	20	1:27 p. m.	1:55 p. m.	0.56	1:29 p. m.	1:42 p. m.	T.	0.31	0.50	0.55	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Binghamton, N. Y	19	5:55 p. m.	8:35 p. m.	0.68	7:42 p. m.	8:02 p. m.	0.02	0.14	0.26	0.52	0.65	0.66	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bismarck, N. Dak	13	8:46 p. m.	10:52 p. m.	1.27	8:55 p. m.	9:14 p. m.	T.	0.15	0.65	0.85	0.98	0.99	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boise, Idaho	4	.....	.....	0.12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.12	.....	.....	.....
Boston, Mass	20-21	.....	.....	0.96	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.50	.....	.....	.....
Buffalo, N. Y	20	10:20 a. m.	1:50 p. m.	0.85	11:40 a. m.	12:02 p. m.	0.28	0.06	0.24	0.39	0.47	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cairo, Ill	19	.....	.....	0.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.28	.....	.....	.....
Charleston, S. C	12	1:52 a. m.	5:35 a. m.	2.61	2:13 a. m.	3:20 a. m.	0.01	0.21	0.40	0.61	0.88	1.22	1.62	1.82	1.95	2.04	2.13	2.23	2.37	.....	.....
Do	24	3:25 a. m.	7:18 a. m.	0.92	3:50 a. m.	4:10 a. m.	0.07	0.04	0.14	0.59	0.72	0.75	0.76	.....	.....	.....	.....	.....	.....	.....	.....
Charlotte, N. C	8	4:27 p. m.	8:30 p. m.	1.88	4:27 p. m.	5:10 p. m.	0.00	0.16	0.45	0.72	1.07	1.37	1.51	1.63	1.75	1.79	1.81	.....	.....	.....	.....
Do	24	4:11 p. m.	5:45 p. m.	1.16	4:20 p. m.	4:45 p. m.	0.03	0.08	0.38	0.65	0.89	1.07	1.10	.....	.....	.....	.....	.....	.....	.....	.....
Chattanooga, Tenn	5	.....	.....	0.15	.....	.....	.....	.....	.....	.....	0.15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chicago, Ill	23	12:53 p. m.	2:45 p. m.	0.64	1:25 p. m.	1:50 p. m.	0.02	0.06	0.21	0.36	0.45	0.51	0.55	.....	.....	.....	.....	.....	.....	.....	.....
Cincinnati, Ohio	18	1:55 p. m.	3:00 p. m.	0.54	2:40 p. m.	2:53 p. m.	0.02	0.09	0.44	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland, Ohio	9	3:58 p. m.	4:40 p. m.	0.48	4:02 p. m.	4:11 p. m.	T.	0.28	0.46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Columbia, Mo	18-19	7:49 p. m.	10:20 a. m.	3.24	8:52 p. m.	9:30 p. m.	0.69	0.11	0.45	0.62	0.79	0.96	1.06	1.14	1.17	.....	.....	.....	.....	.....	.....
Do	31	1:12 p. m.	2:35 p. m.	0.67	1:12 p. m.	1:40 p. m.	0.00	0.07	0.15	0.31	0.51	0.62	0.65	.....	.....	.....	.....	.....	.....	.....	.....
Columbia, S. C	7	5:03 p. m.	D. N.	2.17	5:10 p. m.	5:50 p. m.	0.01	0.19	0.27	0.34	0.66	1.10	1.58	1.91	2.00	2.02	.....	.....	.....	.....	.....
Columbus, Ohio	28	4:39 p. m.	6:15 p. m.	1.41	4:47 p. m.	5:25 p. m.	T.	0.29	0.59	0.79	0.99	1.11	1.19	1.28	1.34	1.36	1.38	.....	.....	.....	.....
Corpus Christi, Tex	26	.....	.....	0.13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.11	.....	.....	.....
Davenport, Iowa	16	7:19 a. m.	8:10 a. m.	0.66	7:27 a. m.	7:50 a. m.	T.	0.14	0.35	0.52	0.62	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....
Denver, Colo	19	.....	.....	0.55	.....	.....	.....	.....	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Des Moines, Iowa	8	2:30 p. m.	4:20 p. m.	0.97	2:42 p. m.	3:15 p. m.	T.	0.11	0.31	0.55	0.66	0.74	0.82	0.87	0.90	.....	.....	.....	.....	.....	.....
Detroit, Mich	2-3	7:30 p. m.	9:40 p. m.	0.60	9:22 p. m.	9:27 p. m.	0.08	0.51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
		10:30 p. m.	1:10 a. m.	1.36	10:45 p. m.	11:40 p. m.	0.08	0.14	0.31	0.42	0.47	0.51	0.58	0.62	0.66	0.72	0.89	0.99	.....	.....	.....
Dodge, Kans	22	6:50 p. m.	7:45 p. m.	1.14	6:57 p. m.	7:06 p. m.	T.	0.55	0.95	1.10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dubuque	16	4:45 a. m.	7:40 a. m.	1.48	6:00 a. m.	6:20 a. m.	0.72	0.23	0.50	0.62	0.68	0.71	0.73	.....	.....	.....	.....	.....	.....	.....	.....
Duluth, Minn	4	12:26 a. m.	7:20 a. m.	1.41	4:29 a. m.	5:12 a. m.	0.16	0.11	0.24	0.35	0.62	0.67	0.80	0.84	0.98	1.06	1.10	.....	.....	.....	.....
Do	29	9:58 p. m.	10:56 p. m.	0.68	10:07 p. m.	10:17 p. m.	0.02	0.37	0.56	0.58	0.61	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....
Eastport, Me	17	.....	.....	0.29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.12	.....	.....	.....
Elkins, W. Va	30	2:55 p. m.	6:40 p. m.	0.90	4:50 p. m.	5:30 p. m.	0.14	0.06	0.13	0.22	0.32	0.49	0.57	0.62	0.66	.....	.....	.....	.....	.....	.....
Erie, Pa	2-3	.....	.....	1.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.67	.....	.....	.....
Escanaba, Mich	2	.....	.....	0.85	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.43	.....	.....	.....
Evansville, Ind	7	.....	.....	0.11	.....	.....	.....	.....	.....	.....	.....	.....	0.11	.....	.....	.....	.....	.....	.....	.....	.....
Fort Smith, Ark	12	.....	.....	0.21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.12	.....	.....	.....
Fort Worth, Tex	23	6:45 p. m.	10:30 p. m.	0.87	6:55 p. m.	7:25 p. m.	0.03	0.08	0.27	0.49	0.68	0.73	0.78	.....	.....	.....	.....	.....	.....	.....	.....
Do	24-25	9:00 p. m.	7:50 a. m.	1.86	4:05 a. m.	4:50 a. m.	0.64	0.20	0.31	0.33	0.37	0.44	0.57	0.65	0.70	0.75	0.77	0.81	.....	.....	.....
Galveston, Tex	25	12:01 p. m.	10:30 p. m.	1.06	2:35 p. m.	3:25 p. m.	0.07	0.04	0.10	0.18	0.24	0.30	0.37	0.50	0.61	0.62	0.70	0.73	.....	.....	.....
Grand Haven	2-3	10:10 p. m.	3:15 a. m.	1.58	11:44 p. m.	12:15 a. m.	0.13	0.15	0.29	0.48	0.80	0.99	1.08	1.14	1.18	.....	.....	.....	.....	.....	.....
Grand Junction, Colo	17	.....	.....	0.14	.....	.....	.....	.....	.....	.....	.....	.....	0.14	.....	.....	.....	.....	.....	.....	.....	.....
Green Bay, Wis	14	4:42 p. m.	6:55 p. m.	0.61	4:48 p. m.	5:00 p. m.	T.	0.21	0.46	0.54	0.55	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Harrisburg, Pa	25	.....	.....	0.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.56	.....	.....	.....
Hatteras, N. C	10	9:00 p. m.	D. N.	1.38	9:09 p. m.	10:10 p. m.	T.	0.08	0.17	0.37	0.50	0.58	0.70	0.82	1.02	1.19	1.22	1.32	.....	.....	.....
Huron, S. Dak	19	.....	.....	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.41	.....	.....	.....
Indianapolis, Ind	19	.....	.....	0.69	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.47	.....	.....	.....
Jacksonville, Fla	13	1:15 p. m.	3:15 p. m.	1.41	1:28 p. m.	2:20 p. m.	T.	0.34	0.37	0.39	0.54	0.70	0.79	0.96	1.08	1.18	1.37	1.39	.....	.....	.....
Do	21	1:38 p. m.	3:30 p. m.	0.94	1:50 p. m.	2:07 p. m.	T.	0.20	0.58	0.84	0.90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	22	2:25 p. m.	5:55 p. m.	2.50	2:27 p. m.	3:02 p. m.	T.	0.11	0.19	0.23	0.45	0.79	1.14	1.19	1.21	.....	.....	.....	.....	.....	.....
Jupiter, Fla	21-22	5:25 p. m.	5:40 a. m.	1.13	5:30 p. m.	5:45 p. m.	0.01	0.07	0.34	0.48	0.49	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kalispell, Mont	3-4	.....	.....	2.17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.20	.....	.....	.....
Kansas City, Mo	1	4:45 a. m	9:45 a. m.	3.62	4:55 a. m.	5:45 a. m.	0.03	0.20	0.33	0.43	0.66	0.87	1.03	1.20	1.37	1.46	1.51	.....	.....	.....	.....
					5:45 a. m.	7:35 a. m.	.....	1.58	1.71	1.85	1.99	2.11	2.26	2.40	2.49	2.58	2.63	2.75	2.94	3.22	3.37
Do	7	12:45 p. m.	3:25 p. m.	1.30	12:55 p. m.	1:36 p. m.	0.01	0.05	0.14	0.22	0.40	0.60	0.84	1.11	1.17	.....	.....	.....	.....	.....	.....
Do	9	6:05 a. m.	4:15 p. m.	2.08	7:20 a. m.	8:05 a. m.	0.04	0.10	0.19	0.39	0.60	0.82	0.92	1.12	1.19	1.29	1.31	.....	.....	.....	.....
Key West, Fla	29	12:30 p. m.	1:35 p. m.	0.81	12:45 p. m.	1:15 p. m.	0.02	0.13	0.39	0.49	0.58	0.65	0.75	0.77	.....	.....	.....	.....	.....	.....	.....
Knoxville, Tenn	12	.....	.....	1.28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.74	.....	.....	.....
La Crosse, Wis	16	3:15 a. m.	6:30 a. m.	1.23	4:15 a. m.	4:45 a. m.	0.16	0.13	0.19	0.38	0.64	0.81	0.89	0.92	0.95	.....	.....	.....	.....	.....	.....
Do	25	3:47 p. m.	10:15 p. m.	0.78	3:55 p. m.	4:15 p. m.	T.	0.12	0.31	0.50	0.60	0.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lewiston, Idaho	2-3	.....	.....	1.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.16	.....	.....	.....
Lexington, Ky	19	4:21 p. m.	5:15 p. m.	1.13	4:25 p. m.	4:57 p. m.	0.01	0.18	0.47	0.71	0.83	0.99	1.05	1.09	1.10	.....	.....	.....	.....	.....	.....
Lincoln, Nebr	17-18	6:20 p. m.	D. N.	2.59	10:55 p. m.	11:25 p. m.	1.09	0.13	0.27	0.41	0.61	0.78	0.96	0.99	.....	.....	.....	.....	.....	.....	.....
Do	22	12:07 a. m.	1:25 a. m.	1.40	12:20 a. m.	1:10 a. m.	T.	0.04	0.21	0.36	0.62	0.84	1.07	1.17	1.22	1.32	1.36	1.39	.....	.....	.....
Do	30-31	8:07 p. m.	D. N.	1.28	8:09 p. m.	8:40 p. m.	T.	0.06	0.26	0.52	0.65	0.73	0.81	0.86	0.88	0.90	0.93	0.97	.....	.....	.....
Little Rock, Ark	30-31	3:55 p. m.	4:15 p. m.	6.23	2:20 a. m.	3:50 a. m.	1.74	0.05	0.09	0.20	0.35	0.50	0.66	0.74	0.77	0.80	0.83	0.93	1.26	1.47	.....
Los Angeles, Cal	1	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.48	.....	.....	.....
Louisville, Ky	10	.....	.....	0.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.69	.....	.....	.....
Lynchburg	29	.....	.....	0.74	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.96	.....	.....	.....
Macon, Ga	24	2:20 p. m.	3:30 p. m.	2.00	2:20 p. m.	3:22 p. m.	0.00	0.09	0.30	0.55	0.70	0.84	0.93	1.10	1.32	1.53	1.66	.....	.....	.....	.....
Do	26	3:24 p. m.	6:45 p. m.	0.81	3:24 p. m.	3:40 p. m.	0.00	0.28	0.45	0.54	0.57	0.62	.....	.....	.....	.....	.....	.....	.....	.....	.....
Memphis, Tenn	31	.....	.....	1.55	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.30	.....	.....	.....
Meridian, Miss	14-15	11:50 p. m.	D. N.	1.11	12:33 a. m.	1:00 a. m.	0.11	0.15	0.37	0.51	0.62	0.71	0.75	0.77	.....	.....	.....	.....	.....	.....	.....
Milwaukee, Wis	14	7:55 p. m.	10:15 p. m.	0.58	7:55 p. m.	8:15 p. m.	0.00	0.06	0.31	0.47	0.51	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....
Montgomery, Ala	3	.....	.....	0.17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.14	.....	.....	.....
Nantucket, Mass	15-16	.....	.....	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.27	.....	.....	.....
Nashville, Tenn	9	.....	.....	0.22	.....	.....	.....	.....	.....	.....	0.22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Haven, Conn	30	3:30 p. m.	5:45 p. m.	0.94	3:35 p. m.	4:25 p. m.	T.	0.15	0.37	0.39	0.42	0.46	0.53	0.60	0.74	0.80	0.86	0.90	.....	.....	.....
New Orleans, La	5	10:40 a. m.	11:02 a. m.	0.46	10:43 a. m.	10:55 a. m.	T.	0.25	0.41	0.45	0.56	0.65	0.91	1.04	1.08	.....	.....	.....	.....	.....	.....
Do	12	4:44 p. m.	5:25 p. m.	1.09	4:50 p. m.	5:10 p. m.	T.	0.27	0.65	0.91	1.05	1.08	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	15	2:27 p. m.	3:47 p. m.	2.00	2:38 p. m.	3:10 p. m.	0.05	0.34	0.70	1.21	1.57	1.78	1.89	1.93	1.94	.....	.....	.....	.....	.....	.....
New York, N. Y	28	6:12 p. m.	6:37 p. m.	0.88	6:12 p. m.	6:27 p. m.	0.00	0.21	0.45	0.88	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Norfolk, Va	10	5:36 p. m.	7:05 p. m.	1.02	6:20 p. m.	6:48 p. m.	0.02	0.08	0.26	0.43	0.60	0.81	0.94	0.97	1.00	.....	.....	.....	.....	.....	.....
Do	15	6:20 p. m.	7:30 p. m.	0.77	6:34 p. m.	6:58 p. m.	0.01	0.17	0.22	0.37	0.57	0.73	0.75	.....	.....	.....	.....	.....	.....	.....	.....
Northfield, Vt	19-20	.....	.....	0.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.22	.....	.....	.....
Oklahoma, Okla	9	.....	.....	1.10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.57	.....	.....	.....
Omaha, Nebr	30-31	7:30 p. m.	D. N.	0.75	8:05 p. m.	8:35 p. m.	T.	0.12	0.30	0.44	0.53	0.57	0.61	0.63	.....	.....	.....	.....	.....	.....	.....
Palestine, Tex	15	1:46 p. m.	3:30 p. m.	1.00	1:52 p. m.	2:40 p. m.	0.01	0.05	0.06	0.08	0.14	0.17	0.28	0.57	0.69	0.75	0.80	.....	.....	.....	.....
Do	24-25	2:45 p. m.	12:20 p. m.	1.40	2:50 p. m.	3:05 p. m.	T.	0.16	0.44	0.68	0.69	0.70	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	25-26	8:25 p. m.	12:25 p. m.	3.77	5:31 a. m.	6:55 a. m.	1.54	0.05	0.12	0.19	0.36	0.56	0.82	0.97	1.15	1.29	1.45	1.57	1.83	.....	.....
Parkersburg, W. Va	18-19	.....	.....	0.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.44	.....	.....	.....
Pensacola, Fla	18	7:57 a. m.	8:26 a. m.	0.72	8:03 a. m.	8:22 a. m.	T.	0.16	0.38	0.58	0.72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia, Pa	3	3:45 p. m.	6:15 p. m.	0.77	4:40 p. m.	4:55 p. m.	0.13	0.19	0.36	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	24	7:12 a. m.	10:00 a. m.	1.21	7:20 a. m.	7:55 a. m.	T.	0.24	0.57	0.66	0.77	0.83	0.86	0.91	0.94	.....	.....	.....	.....	.....	.....
Pittsburg, Pa	18	.....	.....	0.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.31	.....	.....	.....
Pocatello, Idaho	3	.....	.....	0.13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.10	.....	.....	.....
Portland, Me	15	3:05 p. m.	5:30 p. m.	0.82	3:17 p. m.	3:55 p. m.	T.	0.08	0.18	0.29	0.37	0.39	0.44	0.56	0.64	0.66	0.69	0.76	.....	.....	.....
Portland, Oreg	1	.....	.....	0.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.24	.....	.....	.....

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Pueblo, Colo	10	4:40 p. m.	5:35 p. m.	0.57	4:55 p. m.	5:15 p. m.	0.01	0.18	0.41	0.50	0.54	0.55	.....	.....	.....	.....	.....	.....	.....	.....	.....
Raleigh, N. C	29	8:02 p. m.	D. N.	0.89	8:05 p. m.	8:33 p. m.	T.	0.18	0.36	0.46	0.55	0.72	0.77	0.79	.....	.....	.....	.....	.....	.....	.....
Richmond, Va	30	9:48 a. m.	1:35 p. m.	3.47	10:03 a. m.	10:53 a. m.	T.	0.13	0.27	0.37	0.44	0.55	0.63	0.69	0.73	0.80	0.85	.....	.....	.....	.....
					10:53 a. m.	11:50 a. m.	.....	0.90	1.03	1.24	1.46	1.66	2.02	2.45	2.66	2.92	2.97	3.15	.....	.....	.....
Rochester, N. Y	5	.....	.....	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.51	.....	.....	.....
St. Louis, Mo	1	.....	.....	0.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.66	.....	.....	.....
St. Paul, Minn	5-6	9:54 p. m.	3:10 a. m.	2.05	10:55 p. m.	11:46 p. m.	0.20	0.16	0.40	0.55	0.64	0.72	0.75	0.95	1.11	1.30	1.33	.....	.....	.....	.....
Salt Lake City, Utah	2-3	.....	.....	0.36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.17	.....	.....	.....
San Diego, Cal	24-25	.....	.....	0.83	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.25	.....	.....	.....
Sandusky, Ohio	3	1:10 a. m.	4:35 a. m.	0.88	2:15 a. m.	2:35 a. m.	0.27	0.15	0.35	0.48	0.52	0.55	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Cal	19-20	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Savannah, Ga	11-12	8:35 p. m.	D. N.	2.72	8:35 p. m.	9:32 p. m.	0.00	0.15	0.64	0.82	1.14	1.37	1.48	1.71	2.01	2.15	2.26	2.42	2.51	.....	.....
Do	13	1:17 p. m.	5:20 p. m.	1.92	2:42 p. m.	3:47 p. m.	0.10	0.27	0.45	0.70	0.98	1.13	1.23	1.37	1.43	1.44	1.52	1.61	1.76	.....	.....
Do	21	5:33 p. m.	7:33 p. m.	0.84	5:35 p. m.	6:00 p. m.	0.04	0.29	0.48	0.53	0.62	0.67	0.68	.....	.....	.....	.....	.....	.....	.....	.....
Do	27	D. N.	9:40 a. m.	1.29	5:58 a. m.	6:35 a. m.	0.09	0.15	0.23	0.37	0.46	0.54	0.59	0.62	0.63	.....	.....	0.39	.....	.....	.....
Scranton, Pa	17	.....	.....	0.68	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.16	.....	.....	.....
Seattle, Wash	2	.....	.....	0.90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shreveport, La	23	6:42 p. m.	10:29 p. m.	1.63	6:50 p. m.	7:45 p. m.	0.05	0.27	0.55	0.79	0.98	1.01	1.03	1.05	1.17	1.33	1.42	1.48	.....	.....	.....
Do	30	4:15 p. m.	7:45 p. m.	1.62	5:25 p. m.	6:15 p. m.	0.06	0.12	0.21	0.37	0.61	0.84	0.91	1.01	1.14	1.37	1.54	.....	.....	.....	.....
Do	31	5:30 a. m.	11:30 a. m.	1.58	6:25 a. m.	6:40 a. m.	0.25	0.26	0.57	0.72	0.74	.....	.....	.....	.....	.....	.....	0.10	.....	.....	.....
Spokane, Wash	2-4	.....	.....	1.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.49	.....	.....	.....
Springfield, Ill	18-19	.....	.....	0.83	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tampa, Fla	13	10:55 a. m.	12:15 p. m.	1.38	11:17 a. m.	11:55 a. m.	0.09	0.17	0.48	0.79	0.99	1.09	1.18	1.24	1.27	.....	.....	.....	.....	.....	.....
Do	17	3:50 p. m.	8:05 p. m.	0.68	7:22 p. m.	7:30 p. m.	0.09	0.35	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	19	3:58 p. m.	4:45 p. m.	0.69	3:58 p. m.	4:25 p. m.	0.00	0.30	0.45	0.54	0.61	0.65	0.68	.....	.....	.....	.....	.....	.....	.....	.....
Do	26	6:45 p. m.	11:55 p. m.	1.98	7:12 p. m.	7:45 p. m.	0.12	0.28	0.47	0.66	0.92	1.27	1.46	1.55	.....	.....	.....	.....	.....	.....	.....
Taylor	7	5:46 p. m.	6:36 p. m.	1.09	5:49 p. m.	6:20 p. m.	T.	0.22	0.44	0.63	0.79	0.95	1.06	1.08	.....	.....	.....	.....	.....	.....	.....
Do	12	3:10 p. m.	5:45 p. m.	1.31	3:18 p. m.	4:22 p. m.	T.	0.23	0.40	0.57	0.85	0.88	0.92	0.93	1.01	1.10	1.18	1.30	.....	.....	.....
Do	28-29	8:50 p. m.	12:35 p. m.	3.23	12:52 a. m.	2:50 a. m.	0.51	0.08	0.12	0.28	0.32	0.40	0.45	0.50	0.51	0.52	0.52	0.61	0.83	1.37	1.72
Toledo, Ohio	20	D. N.	7:20 a. m.	0.67	5:05 a. m.	5:20 a. m.	0.02	0.23	0.44	0.55	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Topeka, Kans	31	3:18 a. m.	8:15 a. m.	2.08	5:30 a. m.	6:30 a. m.	0.62	0.06	0.10	0.17	0.23	0.37	0.68	0.88	0.93	0.98	1.02	1.16	.....	.....	.....
Valentine, Nebr	29	7:25 p. m.	8:35 p. m.	0.76	7:45 p. m.	8:07 p. m.	0.03	0.09	0.22	0.42	0.66	0.69	.....	.....	.....	.....	.....	.....	.....	.....	.....
Vicksburg, Miss	14-15	8:10 p. m.	D. N.	1.66	9:38 p. m.	10:55 p. m.	0.07	0.07	0.14	0.23	0.38	0.62	0.77	0.84	0.93	0.97	0.99	1.06	1.37	.....	.....
Do	31	5:08 p. m.	6:08 p. m.	1.34	5:33 p. m.	5:57 p. m.	0.02	0.22	0.62	1.06	1.24	1.30	1.32	.....	.....	.....	.....	.....	.....	.....	.....
Washington, D. C	18	4:10 p. m.	5:10 p. m.	0.73	4:30 p. m.	4:55 p. m.	0.01	0.05	0.20	0.57	0.65	0.71	0.72	.....	.....	.....	.....	.....	.....	.....	.....
Wilmington, N. C	30	1:10 p. m.	3:25 p. m.	0.81	1:35 p. m.	1:55 p. m.	0.11	0.20	0.39	0.56	0.64	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....
Yankton, S. Dak	5	4:30 p. m.	10:10 p. m.	1.50	4:37 p. m.	5:00 p. m.	0.01	0.33	0.59	0.74	0.80	0.82	0.83	.....	.....	.....	.....	.....	.....	.....	.....
Basseterre, St. Kitts	24	.....	.....	0.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.45	.....	.....	.....	.....	.....	.....
Bridgetown, Barbados	2	.....	.....	0.93	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.57	.....	.....	.....
Cienfuegos, Cuba	23	6:40 p. m.	7:45 p. m.	0.69	7:18 p. m.	7:35 p. m.	T.	0.10	0.42	0.68	0.69	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	30	8:17 p. m.	9:10 p. m.	1.02	8:20 p. m.	8:48 p. m.	T.	0.19	0.40	0.80	0.89	0.98	1.02	.....	.....	.....	.....	.....	.....	.....	.....
Do	31	9:17 p. m.	9:49 p. m.	0.66	9:25 p. m.	9:45 p. m.	0.01	0.06	0.20	0.43	0.64	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....
Havana, Cuba	20	3:56 p. m.	D. N.	1.46	4:27 p. m.	5:05 p. m.	T.	0.17	0.53	0.65	0.72	0.85	0.91	1.02	1.09	1.10	.....	.....	.....	.....	.....
Kingston, Jamaica	9	.....	.....	0.49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.49	.....	.....	.....	.....	.....	.....
Puerto Principe, Cuba*	12	.....	.....	1.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.39	.....	.....	.....
San Juan, Porto Rico	18	10:50 p. m.	11:15 p. m.	0.76	10:52 p. m.	11:10 p. m.	T.	0.23	0.36	0.67	0.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	24	10:47 a. m.	11:31 a. m.	1.07	10:57 a. m.	11:29 a. m.	T.	0.14	0.23	0.28	0.30	0.39	0.61	0.76	1.03	1.07	.....	.....	.....	.....	.....
Santiago de Cuba, Cuba	18	5:08 p. m.	5:38 p. m.	0.82	5:09 p. m.	5:31 p. m.	T.	0.31	0.47	0.66	0.81	0.82	.....	.....	.....	.....	.....	.....	.....	.....	.....

*Self register not working.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, July, 1902.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure, in inches. Sea level, reduced to mean of 24 hours.	Pressure, in inches. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.70	29.84	—.13	54.4	— 4.9	61.8	47.1	3.79	—0.10	.....
Sydney, C. B. I	29.90	29.94	+.01	63.2	+ 0.9	72.0	54.5	1.58	—2.07	.....
Halifax, N. S	29.86	29.96	.00	63.2	— 0.2	72.2	54.1	1.65	—2.40	.....
Grand Manan, N. B	29.89	29.94	+.01	62.7	+ 1.0	70.9	54.6	1.73	—1.27	.....
Yarmouth, N. S	29.91	29.98	+.03	60.1	+ 0.6	67.1	53.2	3.65	+0.03	.....
Charlottetown, P. E. I	29.88	29.92	+.02	65.0	+ 0.9	74.1	55.8	0.81	—2.68	.....
Chatham, N. B	29.87	29.89	+.01	63.7	— 1.3	76.2	51.2	1.65	—2.54	.....
Father Point, Que	29.87	29.89	+.04	58.2	+ 0.6	67.0	49.3	2.36	—0.68	.....
Quebec, Que	29.61	29.93	+.02	63.4	— 2.1	74.5	52.4	3.79	—0.47	.....
Montreal, Que	29.74	29.94	+.01	67.5	— 1.0	75.1	59.9	3.14	—1.15	.....
Bissett, Ont	29.36	29.96	+.02	65.1	— 0.5	78.4	51.7	5.19	+2.07	.....
Ottawa, Ont	29.67	29.99	+.05	68.9	— 0.6	78.9	58.9	5.98	+2.51	.....
Kingston, Ont	29.64	29.94	—.03	67.0	— 1.2	74.0	60.1	4.52	+1.63	.....
Toronto, Ont	29.59	29.95	—.02	68.9	+ 0.9	78.7	59.1	4.37	+1.45	.....
White River, Ont	28.62	29.91	—.03	62.8	+ 3.3	77.4	48.1	1.78	—1.02	.....
Port Stanley, Ont	29.36	29.99	+.01	68.4	+ 0.6	77.2	59.6	8.45	+5.41	.....
Saugeen, Ont	29.27	29.97	.00	67.3	+ 2.6	75.6	58.9	6.00	+4.02	.....
Parry Sound, Ont	29.28	29.96	.00	67.1	+ 1.1	76.9	57.3	5.07	+2.45	.....
Port Arthur, Ont	29.21	29.92	—.02	63.2	+ 1.2	73.1	53.2	3.03	—0.45	.....
Winnipeg, Man	29.04	29.85	—.08	67.8	+ 1.8	80.0	55.7	1.33	—1.75	.....
Minnedosa, Man	28.10	29.88	—.05	64.8	+ 2.6	76.7	52.9	1.35	—1.25	.....
Qu'Appelle, Assin	27.64	29.84	—.08	62.5	— 1.0	74.1	50.9	0.95	—1.53	.....
Medicine Hat, Assin	27.62	29.86	—.04	64.4	— 3.4	77.8	51.0	2.04	—0.05	.....
Swift Current, Assin	27.35	29.88	—.03	62.7	— 3.8	75.2	50.2	2.28	—0.16	.....
Calgary, Alberta	26.36	29.83	—.07	58.1	— 2.5	69.8	46.5	5.06	+2.38	.....
Banff, Alberta	25.36	29.87	—.03	55.1	— 1.5	68.6	41.6	3.14	—0.10	.....
Edmonton, Alberta	27.57	29.82	—.08	61.1	+ 0.5	72.5	49.7	3.74	+0.71	.....
Prince Albert, Sask	28.29	29.82	—.09	62.1	+ 0.2	74.0	50.2	2.16	+0.11	.....
Battleford, Sask	28.14	29.85	—.05	61.8	— 2.9	73.7	49.8	2.30	—0.04	.....
Kamloops, B. C	28.67	29.86	—.08	67.0	— 1.5	80.0	54.1	0.83	—0.78	.....
Victoria, B. C	29.95	30.04	—.01	60.3	+ 0.3	67.9	52.7	0.37	—0.03	.....
Barkerville, B. C	25.68	29.96	+.05	52.8	— 2.3	66.0	39.6	2.98	—0.04	.....
Hamilton, Bermuda	29.97	30.13	—.01	78.8	+ 0.4	84.9	72.8	2.13	—2.31	.....

TABLE VII.—*Heights of rivers referred to zeros of gages, July, 1902.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,954	14	4.7	1	2.5	24,25	3.6	2.2
Reeds Landing, Minn	1,884	12	4.7	11	2.4	31	3.6	2.3
La Crosse, Wis	1,819	12	5.8	13,14	4.3	30,31	5.0	1.5
Prairie du Chien, Wis	1,759	18	5.8	17	4.2	31	4.9	1.6
Dubuque, Iowa	1,699	15	7.3	22	5.0	31	6.0	2.3
Leclaire, Iowa	1,609	10	6.1	19	3.8	31	4.8	2.3
Davenport, Iowa	1,593	15	8.3	19	5.2	2,3	6.3	3.1
Muscatine, Iowa	1,562	16	10.0	19,20	6.4	2	8.0	3.6
Galland, Iowa	1,472	8	7.5	21,22	3.7	2,5	5.2	3.8
Keokuk, Iowa	1,463	15	15.5	21	6.4	2,5	10.2	9.1
Hannibal, Mo	1,402	13	16.6	23	7.8	6	11.6	8.8
Grafton, Ill	1,306	23	20.4	26	12.7	8	16.6	7.7
St. Louis, Mo	1,264	30	26.9	26	21.2	11	24.4	5.7
Chester, Ill	1,189	30	22.8	27	17.8	12	20.6	5.0
New Madrid, Mo	1,003	34	25.5	7,8	17.6	1	23.3	7.9
Memphis, Tenn	843	33	22.3	10	12.6	1	19.8	9.7
Helena, Ark	767	42	30.0	12	19.1	1,2	27.0	10.9
Arkansas City, Ark	635	42	31.9	12–15	21.9	1	29.0	10.0
Greenville, Miss	595	42	26.6	14,15	17.5	1	23.9	9.1
Vicksburg, Miss	474	45	29.6	16,17	19.3	1	26.2	10.3
New Orleans, La	108	16	8.9	28,30	5.5	5,7,8	7.4	3.4
Yellowstone River.								
Glendive, Mont	98	17	4.0	1	1.7	31	2.6	2.3
James River.								
Lamoure, N. Dak	.....	25	5.9	15	1.1	30,31	2.3	4.8
Huron, S. Dak	210	9	2.8	1	2.0	16,22–26	2.3	0.8
Missouri River.								
Townsend, Mont	2,295	10	5.6	7	3.9	29–31	4.7	1.7
Fort Benton, Mont	2.074	12	3.8	3,5	1.5	31	2.7	2.3
Buford, N. Dak	.....	.....	.....	.....	.....	.....	.....	.....
Bismarck, N. Dak	1,309	14	7.6	10	5.2	31	6.3	2.4
Pierre, S. Dak	1,114	14	8.3	15	5.9	31	6.9	2.4
Sioux City, Iowa	784	19	11.4	18,19	9.5	30,31	10.3	1.9
Omaha, Nebr	669	18	12.1	20	10.3	30,31	11.0	1.8
Plattsmouth, Nebr	641	17	8.7	18	5.7	30	7.5	3.0
St. Joseph, Mo	481	10	9.4	13	5.4	31	7.8	4.0
Kansas City, Mo	388	21	23.2	14,15	14.0	31	19.0	9.2
Boonville, Mo	199	20	18.6	15,16	13.5	1,31	16.1	5.1
Hermann, Mo	103	24	18.0	3	12.9	31	16.0	5.1
Illinois River.								
Peoria, Ill	135	14	21.0	22	15.6	1	18.8	5.4
Youghiogheny River.								
Confluence, Pa	59	10	7.5	1	1.0	28,29	2.8	6.5
West Newton, Pa	15	23	8.9	1	0.8	18	2.3	8.1
Allegheny River.								
Warren, Pa	177	14	7.4	21	2.0	18	4.8	5.4
Oil City, Pa	123	13	8.8	4	2.3	18	5.6	6.5
Parker, Pa	73	20	11.4	4	2.8	18	6.4	8.6
Monongahela River.								
Weston, W. Va	161	18	2.4	1	—0.3	18,29,30	0.2	2.7
Fairmont, W. Va	119	25	7.8	1	1.2	29,30	2.2	6.6
Greensboro, Pa	81	18	11.5	1	6.9	29	8.2	4.6
Lock No. 4, Pa	40	28	14.5	2	6.6	18,29	9.1	7.9
Conemaugh River.								
Johnstown, Pa	64	7	9.2	1	2.4	29	3.5	6.8
Red Bank Creek.								
Brookville, Pa	35	8	4.0	4	1.4	9,24,29	1.9	2.6
Beaver River.								
Elwood Junction, Pa	10	14	7.8	11	2.8	30,31	4.3	5.0
Great Kanawha, River.								
Charleston, W. Va	58	30	7.6	1	4.9	5	6.7	2.7
Little Kanawha River.								
Glenville, W. Va	103	20	3.4	1	—1.4	18	1.0	4.8
New River.								
Hinton, W. Va	95	14	3.1	1	1.2	29	1.7	1.9
Cheat River.								
Rowlesburg, W. Va	36	14	6.0	1	1.6	28,29	3.2	4.4
Ohio River.								
Pittsburg, Pa	966	22	15.3	5	3.5	17	8.7	14.8
Davis Island Dam, Pa	960	25	15.2	5	4.8	19	9.6	10.4
Wheeling, W. Va	875	36	24.0	5	6.0	19	13.1	18.0
Parkersburg, W. Va	785	36	23.0	6	7.8	19	13.2	15.2
Point Pleasant, W. Va	703	39	23.5	7	6.8	20	14.1	16.7
Huntington, W. Va	660	50	26.7	7	10.8	20	17.7	15.9
Catlettsburg, Ky	651	50	26.9	7	9.2	20	17.3	17.7
Portsmouth, Ohio	612	50	26.9	7	10.7	21	18.3	16.2
Cincinnati, Ohio	499	50	27.5	8,9	12.6	23	19.4	14.9
Madison, Ind	413	46	22.8	9	11.0	23	17.2	11.8
Louisville, Ky	367	28	10.2	9,10	6.2	24	8.5	4.0
Evansville, Ind	184	35	21.3	4	8.9	27	15.5	12.4
Paducah, Ky	47	40	19.5	7,8	8.2	1	15.4	11.3
Cairo, Ill	1,073	45	31.0	7	21.2	1	28.1	9.8
Muskingum River.								
Zanesville, Ohio	70	20	17.1	4	6.5	18	9.6	10.6
Scioto River.								
Columbus, Ohio	110	17	6.2	1	3.6	19,20,27,28	4.0	2.6
Miami River.								
Dayton, Ohio	77	18	6.3	1	0.8	27,28	1.8	5.5
Wabash River.								
Mount Carmel, Ill	50	15	14.3	7	3.3	31	8.3	11.0
Licking River.								
Falmouth, Ky	30	25	5.0	2	1.4	28,29,31	2.4	3.6
Kentucky River.								
Frankfort, Ky	65	31	11.5	1	6.1	16-20,26-29	6.8	5.4
Clinch River.								
Speers Ferry, Va	156	20	4.2	2	—0.7	29	0.5	4.9
Clinton, Tenn	52	25	11.6	1	3.3	28	5.4	8.3
Holston River.								
Rogersville, Tenn	103	14	5.6	1	1.6	25,26	2.1	4.0
French Broad River.								
Leadvale, Tenn	70	15	2.5	1	.....	.....	.....	.....
Tennessee River.								
Knoxville, Tenn	635	29	8.0	1	0.8	26–28	2.2	7.2
Kingston, Tenn	556	25	8.5	1	1.2	30,31	2.8	7.3
Chattanooga, Tenn	452	33	10.2	2	1.9	28,29	4.1	8.3
Bridgeport, Ala	402	24	7.9	2	0.6	28–30	2.4	7.3

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Tennessee River.—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Florence, Ala	255	16	6.5	4	0.9	29	2.3	5.6
Riverton, Ala	225	25	7.6	5	—0.5	29	2.1	8.1
Johnsonville, Tenn	95	24	7.8	6	1.4	30	3.4	6.4
Cumberland River.								
Burnside, Ky	516	50	9.2	2	0.7	30	2.4	8.5
Carthage, Tenn	305	40	6.9	4	0.6	28	2.5	6.3
Nashville, Tenn	189	40	9.0	5	1.6	27,28	4.0	7.4
Clarksville, Tenn	126	42	10.7	6	2.1	28	5.3	8.6
Arkansas River.								
Wichita, Kans	832	10	3.7	6	1.8	26,27	2.5	1.9
Webbers Falls, Ind. T	465	23	10.5	2	3.4	30	5.6	7.1
Fort Smith, Ark	403	22	11.8	3	4.5	23,24	6.6	7.3
Dardanelle, Ark	256	21	11.3	4	3.4	26	6.0	7.9
Little Rock, Ark	176	23	12.4	6	5.0	27,28	7.9	7.4
White River.								
Newport, Ark	150	26	12.8	4	1.0	27–30	4.0	11.8
Yazoo River.								
Yazoo City, Miss	80	25	5.0	16,17	—0.2	7	2.5	5.2
Red River.								
Arthur City, Tex	638	27	9.5	27	5.2	12,13	6.2	4.3
Fulton, Ark	515	28	15.0	31	5.6	24	7.8	9.4
Shreveport, La	327	29	12.9	1	5.1	27,28	7.8	7.8
Alexandria, La	118	33	12.3	2	4.7	31	8.2	7.6
Ouachita River.								
Camden, Ark	304	39	24.0	3	4.0	22–29	8.4	20.0
Monroe, La	122	40	14.9	9	2.2	28,29	7.5	12.7
Atchafalaya River.								
Melville, La	100	31	24.9	17–19	19.5	5	23.0	5.4
Susquehanna River.								
Binghamton, N. Y	306	16	12.0	22	3.4	17–19	6.0	8.6
Towanda, Pa	262	16	10.9	22	2.1	18	5.5	8.8
Wilkesbarre, Pa	183	17	15.9	22	5.1	19	9.7	10.8
Harrisburg, Pa	69	17	8.5	9	3.2	18–20	6.0	5.3
West Branch Susquehanna.								
Lock Haven, Pa	65	12	5.1	4	0.1	19,20	1.7	5.0
Williamsport, Pa	39	20	10.8	5	3.1	17	6.2	7.7
Juniata River.								
Huntingdon, Pa	90	24	5.5	1	3.3	27,28	3.9	2.2
Potomac River.								
Cumberland, Md	290	8	3.0	31	1.3	18	2.1	1.7
Harpers Ferry, W. Va	172	18	1.5	4,5	—0.5	{1, 19, 20. / 23–29}	{0.2}	2.0
James River.								
Lynchburg, Va	260	18	1.2	1	0.0	{7–10, 18, / 19, 24–29}	{0.2}	1.2
Richmond, Va	111	12	1.1	8	—0.3	29,30	0.2	1.4
Roanoke River.								
Weldon, N. C	129	30	10.1	12	8.1	29	8.8	2.0
Cape Fear River.								
Fayetteville, N. C	112	38	4.4	1	1.0	24,25	2.1	3.4
Edisto River.								
Edisto, S. C	75	6	3.0	1.2	1.0	28,29	2.6	2.0
Pedee River.								
Cheraw, S. C	149	27	4.1	10,11	1.6	22,23	2.3	2.5
Black River.								
Kingstree, S. C	52	12	0.8	14–17	—0.4	28–30	0.1	1.2
Lynch Creek.								
Effingham, S. C	35	12	4.2	1	2.0	10,11,23-27	2.7	2.2
Santee River.								
St. Stephens, S. C	97	12	8.0	1	1.5	25	4.0	6.5
Congaree River.								
Columbia, S. C	37	15	1.7	14,31	—1.5	6,7	0.6	3.2
Wateree River.								
Camden, S. C	45	24	8.1	26	5.3	22	6.5	2.8
Waccamaw River.								
Conway, S. C	40	7	2.1	13	0.3	20–22	1.3	1.8
Savannah River.								
Calhoun Falls, S. C	347	15	3.7	15	1.9	3–6	2.6	1.8
Augusta, Ga	268	32	9.5	17	6.9	{6, 7, 22– / 24, 29}	{7.6}	2.6
Broad River.								
Carlton, Ga	30	11	4.8	15	2.2	{1, 2, 7, 23, / 24, 27}	{2.5}	2.6
Flint River.								
Albany, Ga	80	20	3.4	28-30	1.1	12	2.2	2.3
Chattahoochee River.								
Westpoint, Ga	239	20	3.9	18	1.8	28	2.7	2.1
Ocmulgee River.								
Macon, Ga	125	18	5.2	15	3.1	4	3.6	2.1
Oconee River.								
Dublin, Ga	79	30	5.5	18	—0.7	11	1.5	6.2
Coosa River.								
Rome, Ga	271	30	2.0	16,30	0.5	26–28	1.1	1.5
Gadsden, Ga	144	18	0.5	1,2	—0.1	27–31	0.2	0.6
Alabama River.								
Montgomery, Ala	265	35	2.0	20,21	0.2	30,31	0.9	1.8
Selma, Ala	212	35	2.5	22	0.4	29	1.2	2.1
Tombigbee River.								
Columbus, Miss	303	33	— 2.5	14	—3.4	9,10,12	—3.1	0.9
Demopolis, Ala	155	35	— 1.2	1	—2.2	22	—1.7	1.0
Black Warrior River.								
Tuscaloosa, Ala	90	43	0.3	1,2	0.0	{4–8, 17– / 23, 28–31}	{0.1}	0.3
Brazos River.								
Kopperl, Tex	369	21	28.0	26	0.0	{2–4, 6, 7, / 10-12, 15, / 17, 19, 20}	{4.0}	28.0
Waco, Tex	301	24	34.4	27	3.4	10	8.9	31.0
Booth, Tex	76	39	30.0	31	0.7	20	5.3	29.3
Red River of the North.								
Moorhead, Minn	418	26	9.5	7,8	8.1	29	8.9	1.4
Columbia River.								
Umatilla, Oreg	270	25	17.8	6,7	13.1	31	15.7	4.7
The Dalles, Oreg	166	40	29.1	7	20.5	31	25.2	8.6
Willamette River.								
Albany, Oreg	118	20	6.2	6	1.5	31	3.7	4.7
Portland, Oreg	12	15	16.4	8,9	10.8	31	13.9	5.6
Sacramento River.								
Red Bluff, Cal	265	23	1.4	1	0.3	26–31	0.6	1.1
Sacramento, Cal	64	29	13.3	1	9.6	23	11.0	3.7

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San Jose de Costa Rica, during July, 1902.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1902.	Normal, 1889-1900.	Observed, 1902.	Normal, 1889-1900.	Observed, 1902.	Normal, 1889-1900.	Observed, 1902.	Normal, 1889-1900.	Duration, 1902.
	660+ *Mm.*	660+ *Mm.*	° *C.*	° *C.*	%	%	*Mm.*	*Mm.*	*Hrs.*
1 a. m	3.90	3.86	18.20	17.75	88	91	0.2	1.1	0.17
2 a. m	3.55	3.54	18.08	17.63	88	91	1.6	1.2	1.00
3 a. m	3.19	3.23	17.71	17.30	89	91	1.9	2.5	1.58
4 a. m	2.96	3.01	17.61	17.14	89	91	0.6	1.3	1.17
5 a. m	2.89	3.01	17.45	17.14	89	91	0.3	0.4	0.58
6 a. m	3.07	3.18	17.48	16.98	89	91	0.0	0.5	0.00
7 a. m	3.44	3.53	17.84	17.20	87	90	2.0	0.6	0.50
8 a. m	3.66	3.84	18.98	19.11	81	85	2.8	0.7	1.34
9 a. m	4.03	4.05	20.75	20.68	74	77	0.4	1.2	1.00
10 a. m	4.14	4.18	21.92	22.27	73	73	1.5	0.8	2.17
11 a. m	4.15	4.10	22.75	23.35	67	70	4.0	1.4	2.42
Noon	3.40	3.84	23.75	23.90	65	69	10.6	4.9	1.08
1 p. m	3.62	3.60	24.32	24.20	68	69	19.7	14.8	2.83
2 p. m	3.12	3.16	24.45	23.95	65	70	2.9	19.0	1.08
3 p. m	2.69	2.81	23.69	23.12	69	75	6.3	23.7	1.75
4 p. m	2.45	2.64	22.55	22.09	76	77	41.7	36.9	6.25
5 p. m	2.50	2.67	21.52	21.07	77	82	20.3	34.9	6.29
6 p. m	2.80	2.94	20.63	20.18	81	84	16.8	37.9	6.08
7 p. m	3.18	3.25	19.73	19.42	85	88	9.8	20.7	5.74
8 p. m	3.56	3.74	19.18	18.85	88	89	9.4	17.8	6.08
9 p. m	3.81	4.06	18.93	18.60	87	89	6.7	8.6	4.66
10 p. m	4.07	4.30	18.78	18.30	87	90	1.3	5.6	1.67
11 p. m	4.20	4.40	18.45	18.08	88	90	0.5	2.9	1.50
Midnight	4.46	4.23	18.31	17.90	88	91	0.1	1.8	0.83
Mean	663.45	663.55	20.13	19.84	81	84	.....	.....	.....
Minimum	660.3	659.83	15.00	13.2	44	.....	.....	.....	.....
Maximum	665.5	666.42	28.20	29.2	100	.....	11.0	.....	.....
Total	.....	.....	.....	.....	.....	.....	163.3	241.0	58.02

REMARKS.—At San Jose the barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard register. ing instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San Jose have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San Jose local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San Jose local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1902.	Normal, 1889-1900.	Observed, 1902.	Normal, 1889-1900.	0.15 m.	0.30 m.	0.60 m.	1.20 m.	3.00 m.
	Hours.	*Hours.*	%	%	° *C.*	° *C.*	° *C.*	° *C.*	° *C.*
7 a. m	4.28	8.18	82	65	20.81	21.15	21.89	21.90	21.66
8 a. m	8.21	15.97	.....	.....	.....	.....	.....	.....	.....
9 a. m	12.36	17.33	.....	.....	.....	.....	.....	.....	.....
10 a. m	8.64	16.33	87	71	20.91	21.10	21.90	21.95	.....
11 a. m	8.45	14.94	.....	.....	.....	.....	.....	.....	.....
Noon	8.50	10.32	.....	.....	.....	.....	.....	.....	.....
1 p. m	12.76	9.65	86	82	21.24	21.22	21.93	21.94	.....
2 p. m	13.40	8.84	.....	.....	.....	.....	.....	.....	.....
3 p. m	12.32	7.58	.....	.....	.....	.....	.....	.....	.....
4 p. m	8.76	5.17	89	92	21.51	21.33	21.90	21.92	.....
5 p. m	3.75	3.19	.....	.....	.....	.....	.....	.....	.....
6 p. m	1.42	1.02	.....	.....	.....	.....	.....	.....	.....
7 p. m	.....	.....	84	89	21.47	21.36	21.91	21.90	.....
8 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m	.....	.....	76	79	21.29	21.34	21.92	21.90	.....
11 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	84	80	21.21	21.27	21.91	21.92	21.66
Total	102.85	118.52	.....	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, July, 1902.*

Stations.	Height above sea level.	Observed, 1902.		Averages.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Meters.	*Mm.*			*Mm.*	
Sipurio (Talamanca)	60	391	23	2	287	20
Boca Banano	3	368	25	6	303	20
Port Limon	3	409	21	7	464	18
Swamp Mouth	3	483	24	4	222	12
Zent	20	352	24	1	209	19
Siquirres	60	271	20	3	268	18
Dos Novillos	122	444	23	.....	.....	.....
Guapiles	300	553	24	2	127	24
Cariblanco (Sarapiqui)	835	556	29	4	496	27
San Carlos	161	426	27	4	449	26
Las Lomas	266	.....	.....	2	380	16
Peralta	332	439	22	4	286	24
Turrialba	620	455	28	7	239	21
Juan Viñas	1,040	263	21	6	207	17
Santiago	1,100	188	23	1	290	22
Paraiso	1,336	238	17	1	88	23
Cachi	1,020	*	*	.....	.....	.....
Las Concavas	1,337	169	23	.....	.....	.....
Cartago	1,450	*	*	.....	.....	.....
Tres Rios	1,300	73	16	13	214	16
San Francisco Guadalupe	1,187	142	13	6	281	23
San Jose	1,160	163	25	13	253	22
La Verbena	1,140	134	17	6	259	21
Nuestro Amo	791	63	13	6	226	16
Alajuela	950	61	6	2	466	25
San Isidro Alajuela	1,346	271	17	1	549	27

* Not received.

TABLE 4.—*Observations taken at Port Limon and Zent, July, 1902.*

Stations.	Pressure.			Temperature.			Relative humidity.
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	
	Inches.	*Inches.*	*Inches.*	° *C.*	° *C.*	° *C.*	%
Port Limon	.....	.....	.....	22.1	32.0	25.54	88
Zent	.....	.....	.....	20.0	36.9	25.69	88

Stations.	Cloudiness.	Sunshine.	Rainfall.		Temperature of soil at depth of—		
			Amount.	Number of days.	0.15 m.	0.30 m.	0.60 m.
	%	*Hours.*	*Mm.*		° *C.*	° *C.*	° *C.*
Port Limon	62	.....	408.9	21	.....	.....	.....
Zent	79	148.21	332.0	24	27.11	27.13	27.14

MEXICAN CLIMATOLOGICAL DATA.

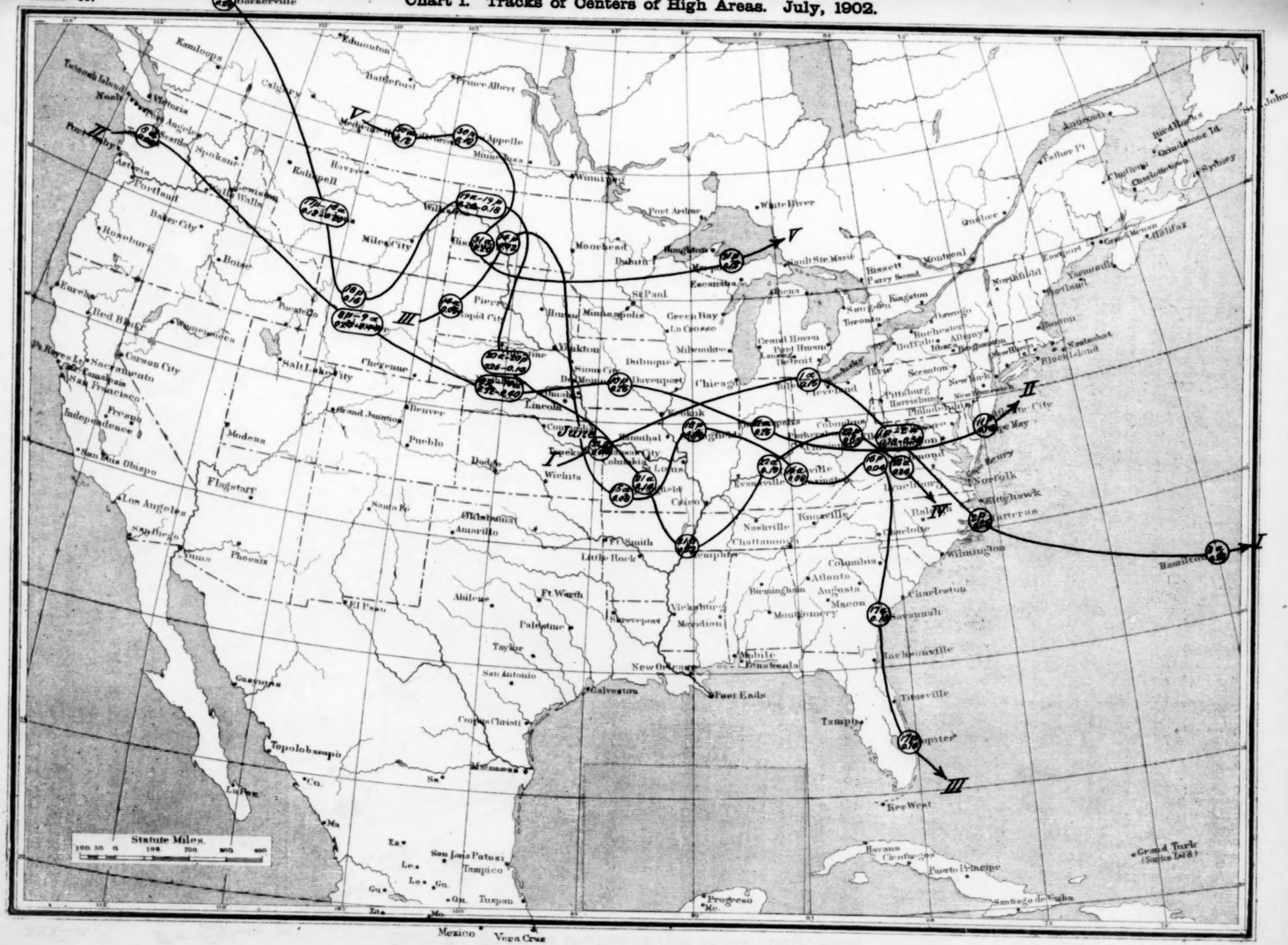
By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

July, 1902.

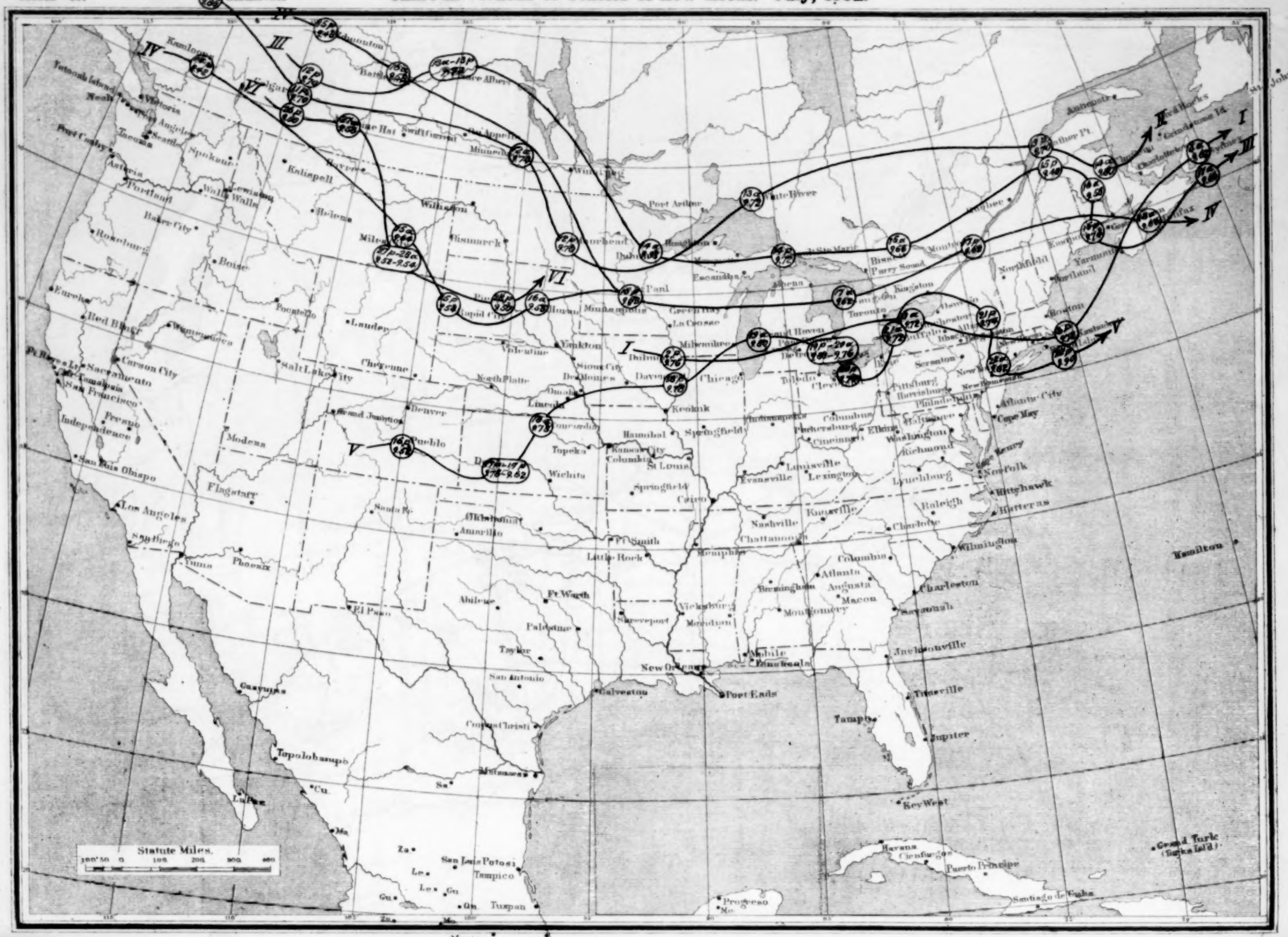
Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Chihuahua	4,683	25.25	91.4	60.8	74.1	60	6.42	ne	.....
Colima	1,600	28.35	95.7	64.0	78.6	79	5.41	s.	.....
Guadalajara (Obs. del. Est.)	5,186	24.93	83.3	56.1	69.3	73	10.78	n.	.....
Guanajuato	6,640	23.67	84.2	53.1	65.7	67	7.46	ene.	.....
Leon (Guanajuato)	5,906	24.26	85.5	55.2	67.5	77	8.17	s.	.....
Mazatlan	25	29.84	90.1	73.0	82.9	75	2.98	nw.	.....
Merida	50	29.91	96.8	64.9	82.0	76	5.05	ne.	.....
Mexico (Obs. Cent.)	7,472	23.02	78.8	48.7	61.9	70	5.61	ne.	ne.
Monterey (Seminario)	1,626	28.12	100.0	67.5	78.1	57	0.86	se.	.....
Morelia (Seminario)	6,401	23.85	78.8	53.6	61.9	80	6.67	sw.	ne.
Puebla (Col. Cat.)	7,108	23.36	77.0	54.0	64.6	75	5.57	e.	.....
Puebla (Col. d Est.)	7,118	23.34	77.0	48.9	61.9	74	7.34	e.	.....
Queretario	6,070	24.93	89.6	55.4	66.2	71	9.68	e.	.....
Saltillo (Col. S. Juan)	5,399	24.76	92.5	62.6	73.4	67	6.61	nne.	.....
Toluca	8,812	21.97	73.8	45.0	57.6	74	5.17	se.	.....

Chart I. Tracks of Centers of High Areas
XXX—59.
Barkerville

Chart I. Tracks of Centers of High Areas. July, 1902.



XXX—60. Chart II. Tracks of Centers of Low Areas. July, 1902.



XXX—61. Chart III. Total Precipitation. July, 1902.

Chart III. Total Precipitation. July, 1902.

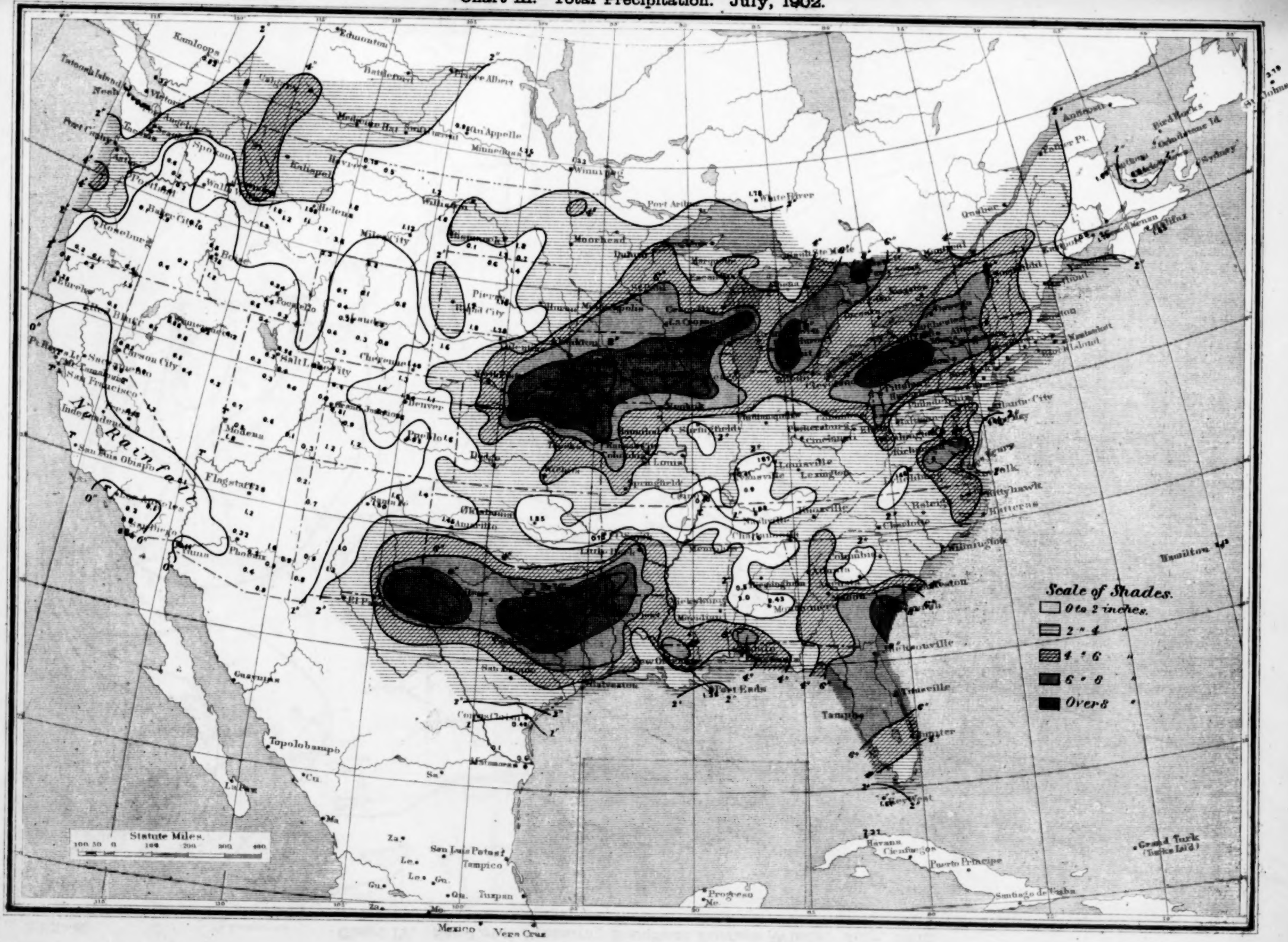
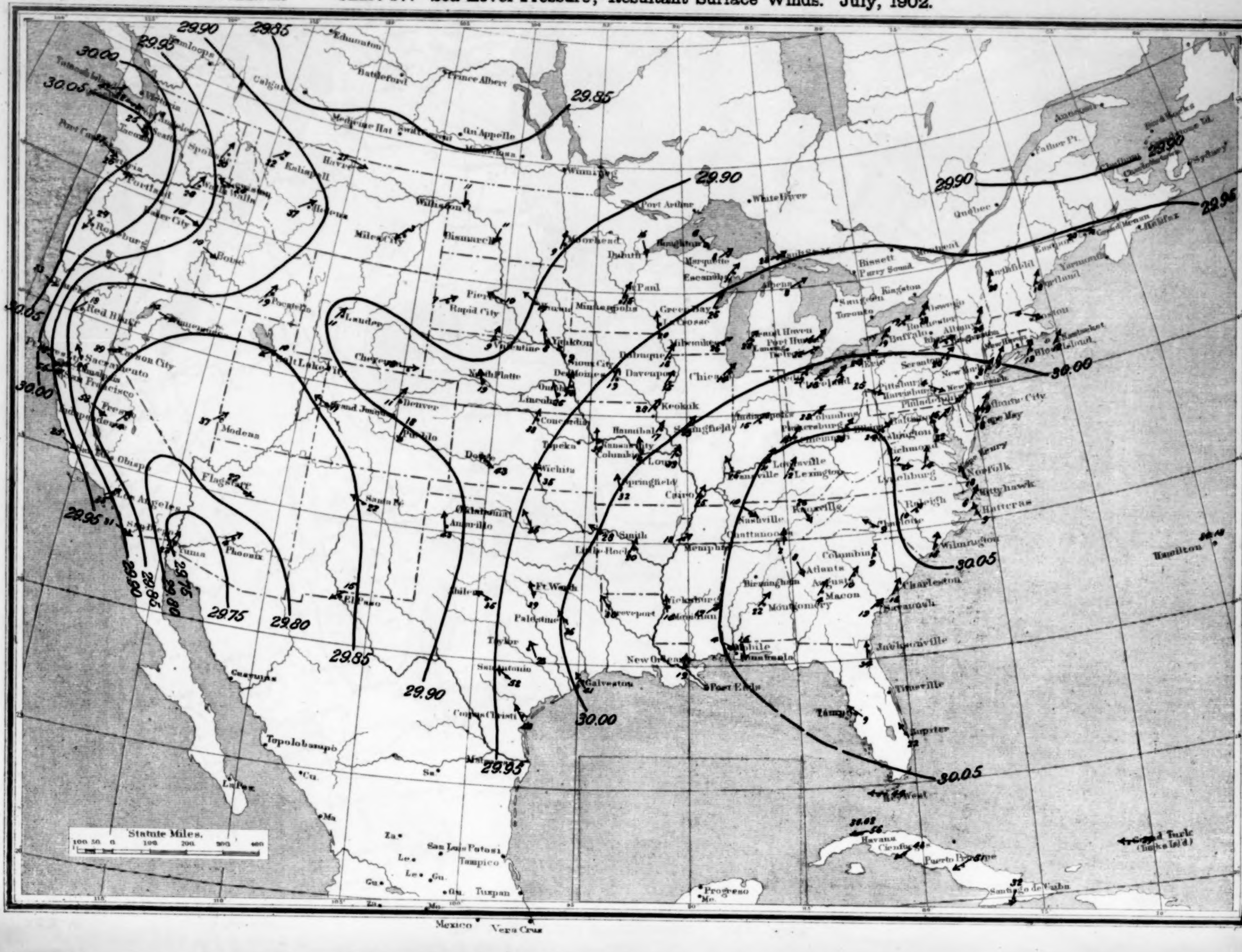
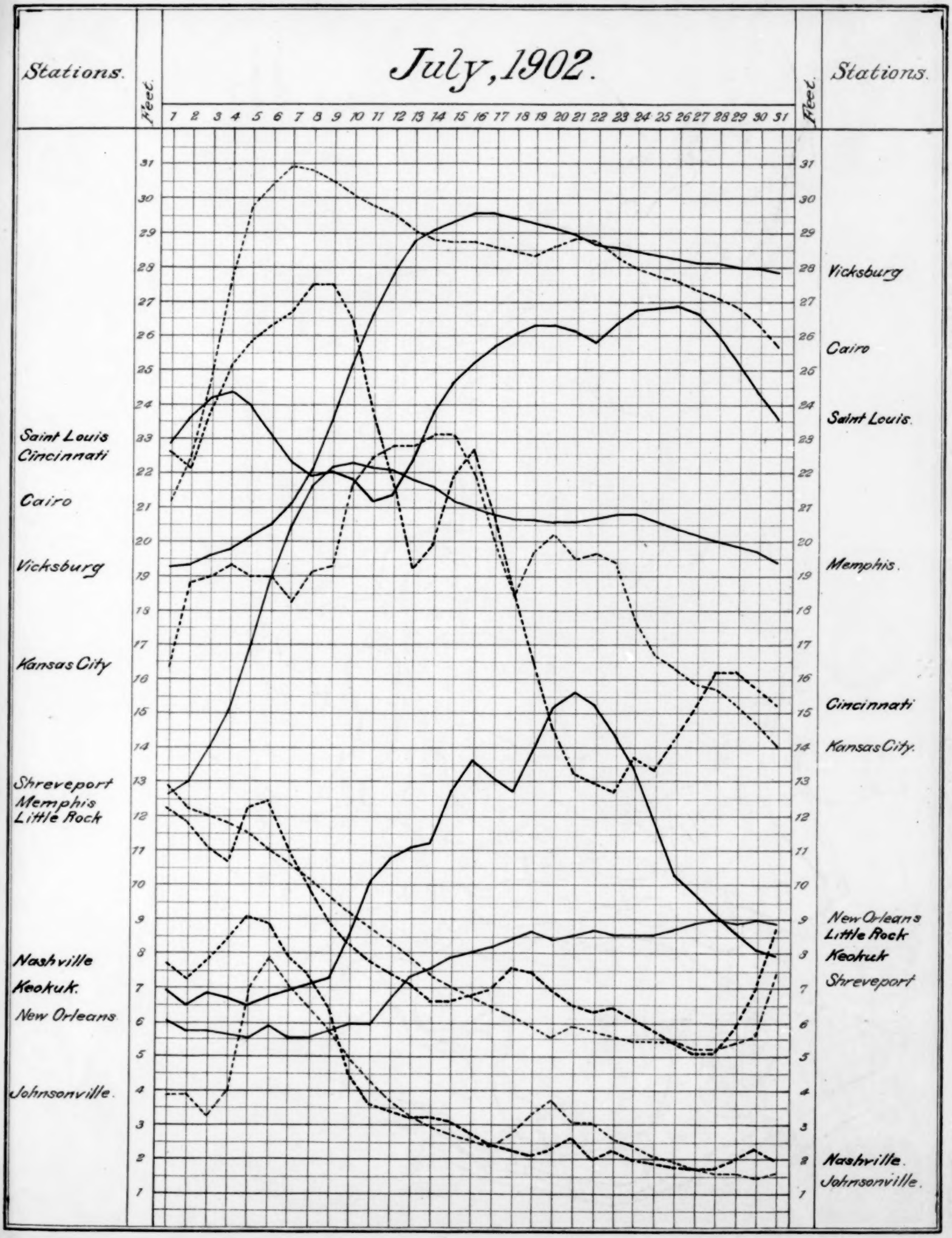


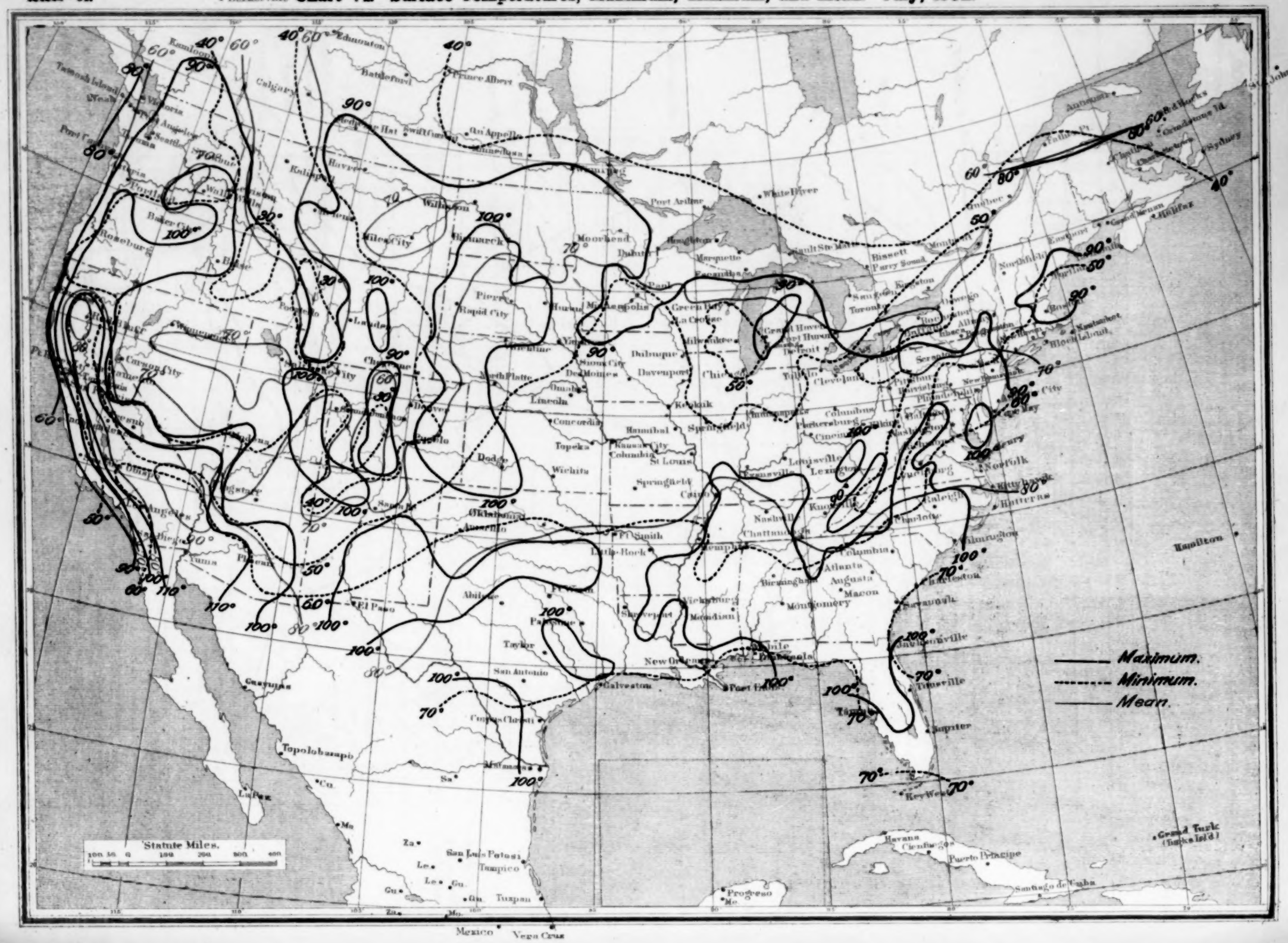
Chart IV. Sea-Level Pressure; Resultant Surface Winds. July, 1902.



XXX—63. **Chart V. Hydrographs for Seven Principal Rivers of the United States. July, 1902.**



• Barkerville **Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. July, 1902.**



• Barkerville **Chart VII. Percentage of Sunshine. July, 1902.**

Chart VII. Percentage of Sunshine. July, 1902.

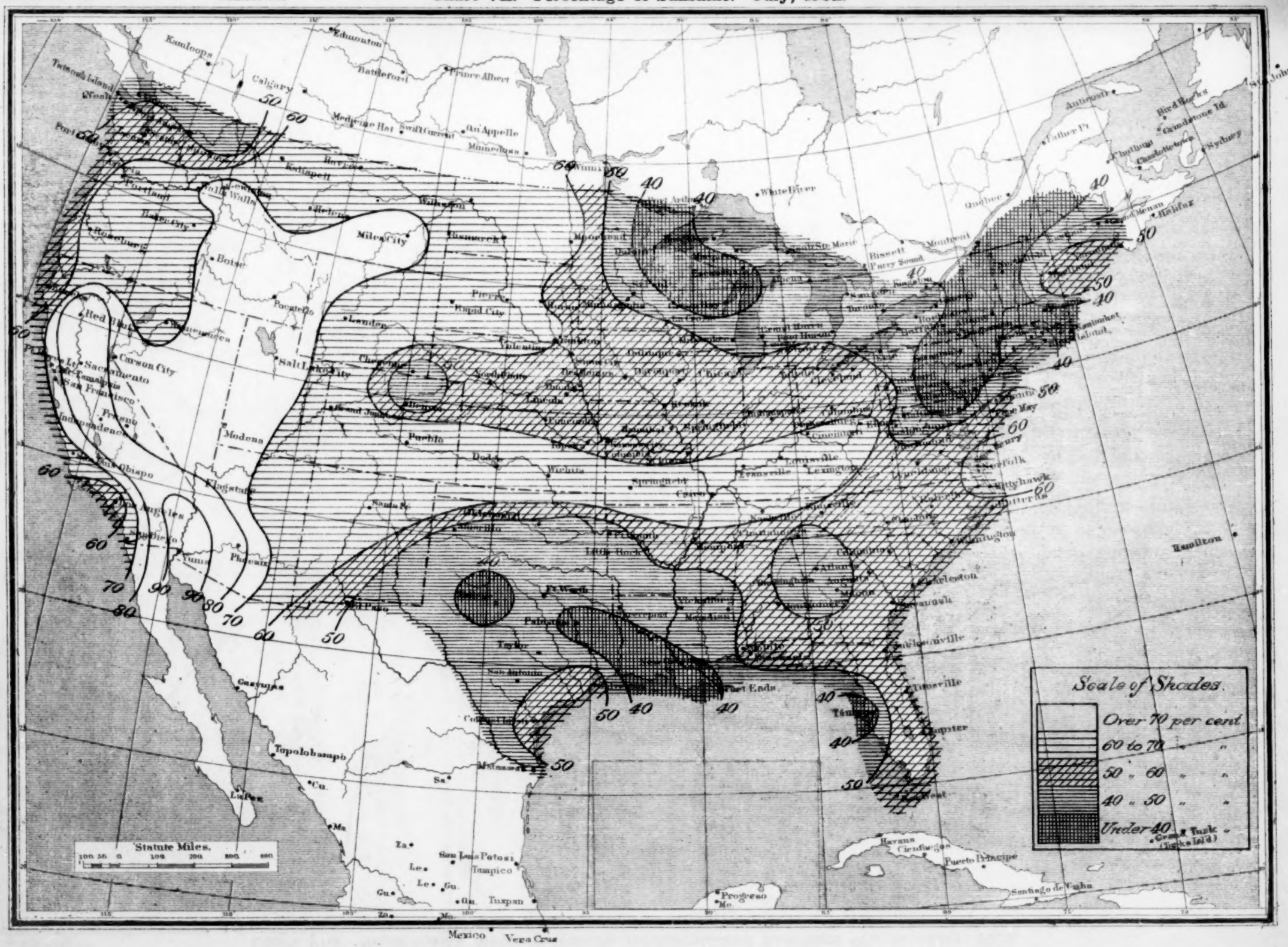
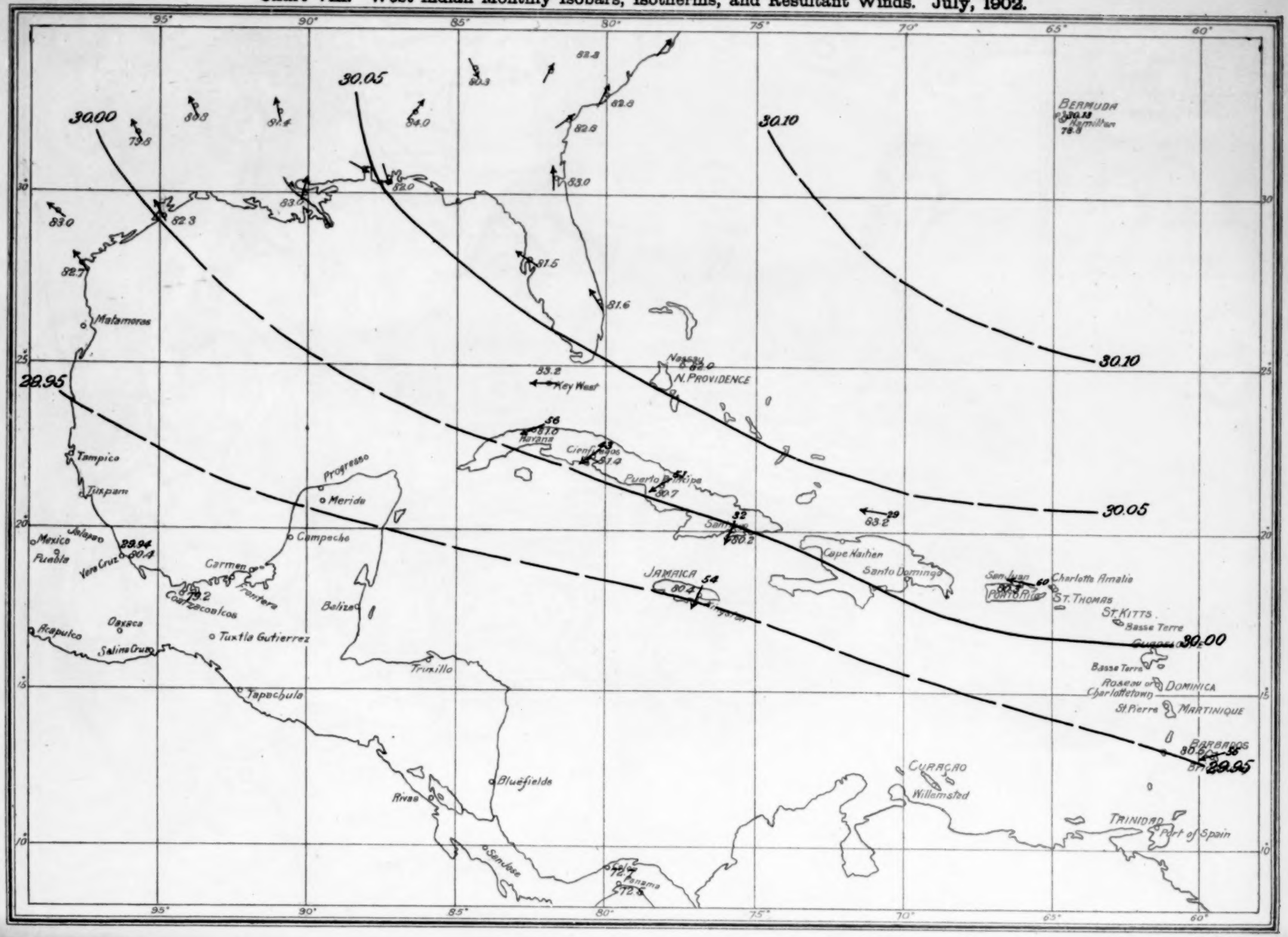



Chart VIII. West Indian Monthly Isobars, Isotherms, and Resultant Winds. July, 1902.